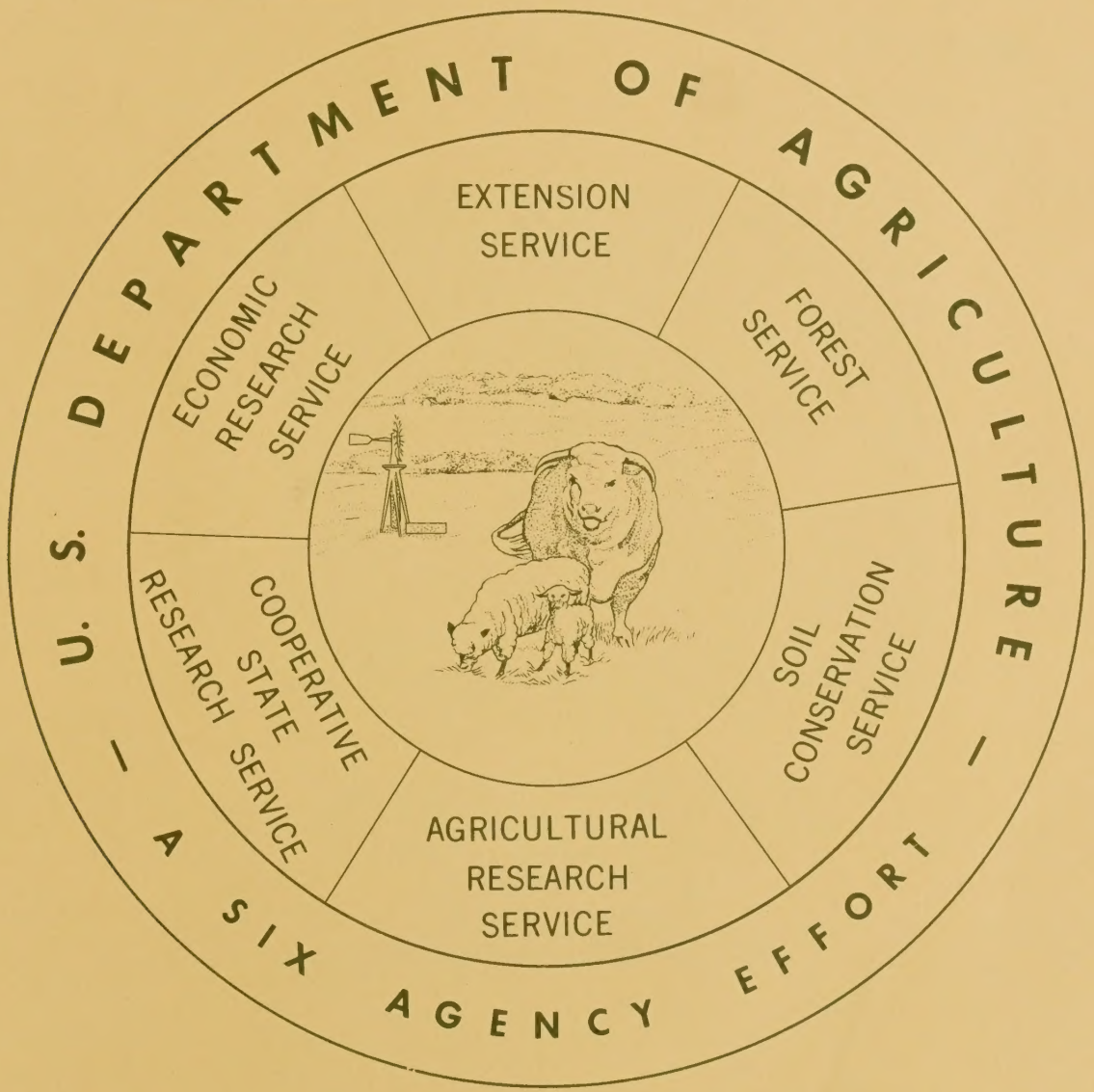
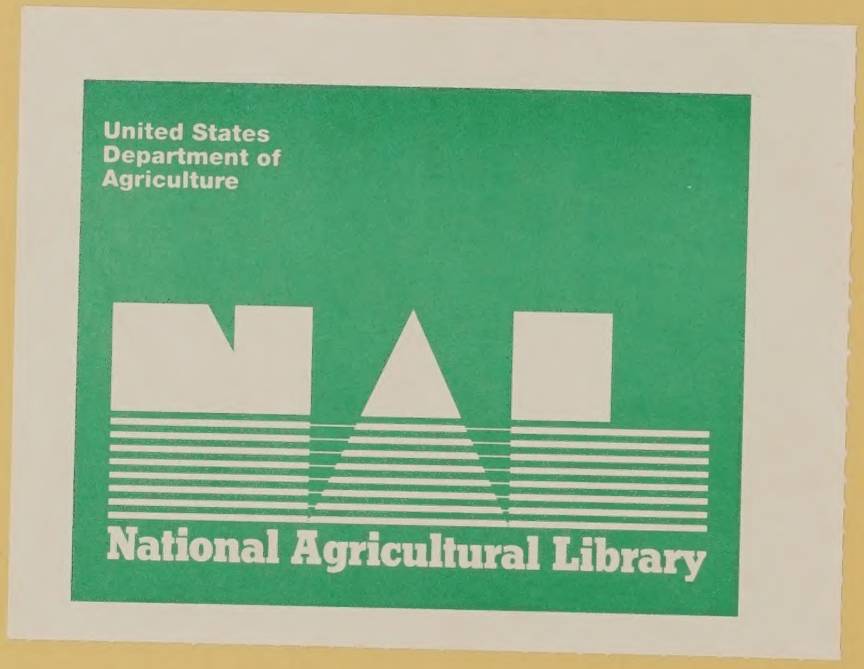
ortunities to Increase Meat Production
n Ranges of the United States



Phase I -- Non-Research

JUNE 1974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Opportunities to Increase Red Meat Production from Ranges of the USA (non-Research)

Phase I
(Phase II will cover Research)

Prepared by the
USDA Inter-Agency Work Group on Range Production
Representing

Agricultural Research Service
Cooperative State Research Service
Economic Research Service
Extension Service
Forest Service
Soil Conservation Service

June 1974

THE ASSIGNMENT

This report was commissioned in December 1973 by Robert W. Long, Assistant Secretary of Agriculture for Conservation, Research and Education.

A Work Group representing the five USDA Agencies in Conservation, Research and Education was assigned to "prepare a USDA viewpoint on accelerating meat production from rangelands." The Group was expanded to include Economic Research Service.

Objective of the study as defined by the Work Group was:

> *"To present for consideration of the Secretary a report on cost-effective opportunities to increase red meat production from America's ranges by a program of research, education, extension, cooperation and action, giving consideration for environmental values and contributing to rural development."*

Scope of the assignment was modified by the Assistant Secretary and his Agency Heads to a two-phase effort.

--Phase I--Opportunities excluding Research

Preparation of recommended programs and necessary financial plans for achieving the opportunities was not to be part of the Phase I effort.

--Phase II--Research Opportunities

This report presents the findings of Phase I.

The Phase I effort drew heavily upon current literature and unpublished reports and data as well as accumulated experience of the Work Group and associates. In addition, the possible impacts of changing energy and food supplies, inflation, and expanding international trade upon demand for range and meat, were carefully evaluated. Elements found relevant were traced through the meat consumption-livestock-livestock feed relationships. These provided the basis for establishing the limits of demand that were considered in relation to potential supply.

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Opportunities to Increase Red Meat Production
from Ranges of the USA
(non-Research)

U. S. Department of Agriculture

GENERAL NATURE OF RANGE AND ITS USES

RANGE AND RANGELAND DEFINED

The definitions below have been accepted and used in this study.

> *Range is all land producing native forage for animal consumption and land that is revegetated naturally or artificially that is managed like native vegetation. Range embraces forestlands that support an understory or periodic cover of herbaceous or shrubby vegetation available for large herbivores*

> *Rangeland has been defined by the Society for Range Management as "land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs or shrubs suitable for grazing or browsing and present in sufficient quantity to justify grazing or browsing use. Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes and wet meadows."*

Included in these definitions are sizeable areas in the humid portions of the nation that many would term pastures and forage producing lands, and for which the only practical uses are the production of forage for livestock or growing trees. Thus, the definition used here embraces much more than the arid and semiarid lands of the western 17 states.

RANGE USE

Range, consisting of grasslands, shrublands and open forests covers more than one billion acres--54 percent of the land area of the 48 states. Because of climate and soil, rangelands (grasslands and shrublands) cannot grow cultivated crops consistently year after year. For the most part, these lands have no alternative for contributing to food production for man other than by way of the grazing animal. Yet they have many other values and uses including watershed, wildlife habitat, and recreation.

Use for Livestock Production

Much of the range has been grazed by livestock for at least 100 years--some of it for as long as 350 years. Before that, native herbivorous animals such as buffalo, antelope, elk and deer grazed these lands for many centuries. With the coming of Europeans and their domestic livestock, grazing pressure increased, and over two or three decades--especially late in the 1800's and early 1900's--the vegetation on many western ranges deteriorated. Parts of the range were abused and overgrazed in the Southwest by livestock, primarily sheep, as early as 1700. While many ranges recovered, evidence of overgrazing still persists. Some ranges, including forest areas still are being improperly grazed.

During the settlement era, millions of acres of rangelands were planted to wheat and other crops. Many of these lands were marginal for crops and were abandoned following periods of drought and low prices. Conservation efforts beginning in the 1930's have resulted in conversion of much of the marginal croplands to permanent grass cover. Soil conservation districts were formed throughout the country through which systems of rangeland management were developed by private landowners to implement improvement of previously overgrazed rangelands.

The federal lands have played important roles in range livestock production. Settlers and itinerant stockmen grazed free of management control upon public domain lands (now called the National Resource Lands) until passage of the Taylor Grazing Act in 1934. Other public domain lands which beginning in 1891 were designated as Forest Reserves--now, National Forests--also were grazed without control in the late 1800's until 1905 when the Forest Service began a program of grazing control and management.

Non-livestock uses

In addition to livestock grazing, many ranges also are valuable as watersheds, wildlife habitat, and recreational lands. Therefore, potentials for integrated uses are high for many range areas, and conflicts of interest among users and uses can be great.

Proper livestock grazing can be compatible with or even complementary to other resource uses. Livestock grazing and strategic manipulation of vegetation on watersheds have been shown to increase forage production, soil protection, and yield of high quality water. Many species of wildlife can benefit from grazing systems that promote good cover for mating sites and that enhance food supply and other habitat requirements. Furthermore, cattle grazing during spring and early summer reduces competition from grasses and allows browse plants to grow more vigorously for increased big game feed during the winter. On many grass-shrub ranges, livestock grazing can reduce the potential of fire by preventing a buildup of fuel. Aesthetic values of landscapes can be enhanced through use of grazing systems and manipulation of vegetation that creates contrast in vegetation color and form.

RANGE ECOSYSTEMS

A statistical summary of the range and forest lands of the United States excluding the states of Alaska and Hawaii is shown in Appendix Table 1. A discussion of each major range subdivision--grasslands, shrublands, western forests and eastern forests--follows.

Grasslands

Grasslands occupy about 18 percent of the land area of the United States. The largest portion of these ranges is found in areas receiving 10 to 16 or 18 inches of precipitation annually. However, grasslands are found in varied environments. Wet grasslands are found in the warm, moist coastal areas of the United States, especially along the coastlines of the south and southeast. The desert grasslands occur in the relatively hot, dry semi-desert region of the southwest. Alpine grasslands occupy the cold high mountain landscapes above timberline in the Rocky Mountains and in the Sierra Nevada Mountains. The largest expanse of grasslands occurs in the plains region east of the Rocky Mountains and west of the deciduous forest. These plains grasslands account for about 21 percent of all range and 62 percent of all grasslands and contains the most productive range ecosystem in the United States. This is the tall grass prairies including the Flint Hills of Kansas and Oklahoma and the Sand Hills of Nebraska.

The soils are generally well developed, having a surface horizon high in organic matter and subsoils with clay accumulation and relatively well developed structure. The most favorable soils in this region have been plowed for cropland.

Three other grasslands, the Palouse bunchgrass, Pacific bunchgrass and the annual grassland, are also important grazing areas. The Pacific bunchgrass found in central California, and the Palouse prairie in Idaho, Washington and Oregon, are highly productive. Much of the land has been cultivated, leaving only the steep landscapes in native vegetation. Since these remaining bunchgrass ranges are found mainly in foothill areas, they are sometimes included with the mountain grasslands.

The mountain grassland types are found as wet or dry meadow types of high production. They furnish favorable habitat for both livestock and big game. The annual grassland is found primarily in California. This annual type is highly variable in forage growth from year to year but can produce high livestock gains under proper management.

Shrublands

Shrublands occupy about 14 percent of the total land area of the United States and about 26 percent of the range. They are found on the driest ecosystems of the desert areas of the Southwest and the salt deserts of the Great Basin. Under favorable moisture conditions, shrubland ecosystems may occur in mountainous areas. Sagebrush and much of the desert shrub ranges are found in the cold deserts of the Great Basin. The soils of the Sagebrush area are high to intermediate in productivity, depending on altitude and topography. They extend throughout the foothills and montane zones of the Intermountain area. Many desert shrub ranges are typified by salt-affected soils of low productivity of the lower valley basins which are capable of growing only salt-tolerant plants.

The Southwestern desert portions of the desert shrub range are typical of the hot desert of the United States. Such range is usually low in productivity because of lack of moisture. It supports both a perennial grass understory dependent upon late summer precipitation and an annual vegetative understory dependent upon winter and early spring precipitation.

Other shrubland on more favorable sites includes the mesquite savanna of Texas and Oklahoma and the chaparral types of California and Arizona. Mesquite savanna has resulted from years of gradual encroachment of mesquite onto once productive grasslands. The mesquite canopy results in substantial loss of moisture through transpiration and reduces forage production drastically. The area is noted for its high populations of white-tailed deer. Chaparral also includes the mixed mountain shrub type of the Rocky Mountains. The mixed mountain shrub ecosystem may consist of a wide variety of plant communities such as: oakbrush, chokecherry, snowberry, service berry, bitterbrush, and high elevation sagebrush. Mountain shrub types provide excellent habitat for big game and livestock. Some mountain brush and chaparral types become so dense that movement of grazing animals and understory production is restricted.

Western Forests

Most western forests may also be classified as range. These include the open forests such as: ponderosa pine, fir-spruce, lodgepole pine, pinyon-juniper, and the hardwood forests of oak and aspen. These forest types provide forage as understory vegetation and in natural or created openings in the timber stand. Climatic conditions are favorable for plant growth; as a result, the understory contains a rather high diversity of species. Forage yields depend mainly upon density of the overstory timber stand. Such forest areas are used mainly as summer range for domestic livestock and for big game. However, the lower elevation ranges are often used year round by deer and elk.

The pinyon-juniper woodland is found in the foothill zone of the west, mainly in Utah, Arizona and New Mexico. These areas are used for spring grazing before the high elevation range is ready and again in the fall before livestock drinking water, from winter snow, is available on desert ranges. Pinyon-juniper ranges receive more precipitation and have better soil than the desert shrub ranges but have less favorable climatic conditions than the grasslands.

Other western forests, including west coast Douglas-fir, hemlock-Sitka spruce, larch and redwood, support only a few livestock.

Eastern Forests

Deciduous forests of the East are used for livestock production to a limited extent, but they support good populations of white-tail deer. The productivity of these forests for forage depends upon the presence of an understory vegetation of mixed grass, forbs, shrubs, and tree reproduction. Hardwood tree reproduction is often severely grazed and damaged by cattle and a conflict between timber production and grazing of domestic livestock in commercial hardwood forests sometimes exists.

The most important range of the East is found in the southern pine region. Such forest types as longleaf-slash pine and loblolly-shortleaf support large populations of domestic livestock. Grazing is a desirable use of these forest ranges during a portion of each timber growth cycle. Here, as in the West, the amount of forage available for livestock usually depends upon the density of the timber canopy. Open stands of trees generally produce more forage than where the tree canopies are closed. Formerly cleared areas, referred to as native pasture, presently support sparse stands of trees. Here, good, dense stands of grasses and forbs afford considerable forage for livestock use.

INTERRELATIONS OF RANGE GRAZING WITH OTHER SOURCES OF FEED ENERGY

Range management is planning and directing the grazing of range to obtain maximum and efficient livestock production consistent with the wise use of range resources--vegetation, soil, water, and wildlife. Good range management includes application of accepted and recommended livestock husbandry and management practices.

It is possible and often necessary to supplement or complement range with other sources of feed energy and other nutrients in order to maintain a stable, balanced forage livestock program. Many times this can be accomplished with already existing pasture, haylands, or croplands without additional energy input. Some of the more common supplementary and complementary methods necessary or beneficial to a sound, balanced range livestock program are discussed below. Several of the methods offer the option of grazing brood cows on range while early-weaned calves are intensively managed on the non-range feed supply.

Emphasis is given to systems used with range cattle. The principles expressed, however, generally apply to range sheep operations. Descriptions of livestock grazing operations by major geographic areas as they relate to range use are detailed in Appendix B.

Winter Supplementation

Growing range vegetation provides most of the nutrients needed for livestock production; however, during the fall of the year, protein, phosphorus and carotene decrease quite rapidly. Range forage must be then supplemented if livestock are to receive adequate nutrients.

A large percent of the cows wintered in much of the range area obtain the major portion of their winter ration from mature grass on "winter range." A full feed of most common roughages will usually supply adequate energy, but not always other essential nutrients. Standing grasses on ranges in the west when grazed along with some browse species provide valuable winter feed for bred beef cows; however, for efficient calf production, young animals grazing winter ranges should receive supplemental feed, especially protein.

The amount of supplemental feed needed for range cows during the winter depends primarily upon (1) the quantity and quality of range forage, hay, or roughage available; (2) the age and condition of the cow; (3) the length and severity of the winter; and (4) the date of breeding. The amount and kind of winter supplements provided to range cows varies from area to area because no single winter supplement provides adequate nutrients at the lowest cost under all winter range conditions.

While winter supplementation is most common, supplementation of range at other seasons sometimes is necessary. The critical determinant, be it winter or another season, is whether or not the range forage furnishes adequate nutrition for the kind and condition of the livestock.

Harvested Feeds

Range livestock producers actually are in the business of merchandising range forage through livestock. To effectively manage a livestock enterprise it is necessary to develop a grazing program that efficiently utilizes forage plants and produces the most pounds of red meat, and in the case of sheep and goats, wool and mohair, commensurate with other resource management goals. Use of harvested feeds often can help meet these goals.

A large number of harvested feeds in the form of hay (legume and non-legume) silage, haylage, fodder, straw, etc., are utilized to complement and supplement range. Also, there are a vast number of methods by which these feedstuffs are harvested. However, the point here is not the harvested forage or harvesting method, but rather the interrelationship of this source of energy with range grazing to increase red meat production.

If a producer has to utilize supplemental feed to maintain range livestock during growing seasons with normal rainfall, there is generally either an excess of unpalatable and unproductive plants or too many animals are grazing the area. However, some range producers have access to economical sources of harvested feeds that can be utilized in either complementary and/or supplementary forms to increase red meat production and profits.

Hays

Non-legume hays are used extensively as supplemental energy sources to range in the winter months, especially when weather conditions are such athat livestock cannot graze. In some range livestock management systems hay is fed in non-winter periods because it is more practical and/or economical than to supply energy from range forage; in many locations, prolonged drought necessitates feeding of hay. Legume hays are also used to supplement range; however, they are used as much for their protein and carotene content as they are for energy.

Silage

Whenever corn and forage sorghums can be successfully grown, corn and sorghum silages are excellent winter feeds for the breeding herd. These harvested feeds have high yields per acre. Thus, some producers have found it economical to increase stocking rates on their range and any time the range will not support the herd it is put into a feed-lot and fed silage. However, these silages alone are not well-balanced rations so they have to be supplemented with protein.

Silages are also used as winter energy supplements to range that has been excessively utilized during the growing season. Again, as in the case of hay, some producers have this alternative in their range system. There are also other silage crops. However, corn and sorghum make up for the major portion of silage utilized by range livestock.

Complementary Pasture

In many areas of the country cropland and range are intermingled. Where this situation exists, cropland pastures of sudan and other warm-season and cool-season grass species provide grazing for livestock seasonally, offering a balanced program when combined with the grazing of adjoining, or nearby range. Thus, in these areas, the complementary use of range, tame pasture, and farmed forage gives producers the opportunity to develop a more stable and more productive system for producing red meat from range.

Cattle in a complementary system can be moved to and from native range to obtain proper intensity and frequency of use on the high producing pasture that usually must be harvested on a rigid schedule to prevent waste or abuse of the forage resources. On the other hand, native range can benefit from spring, summer, and fall rest, depending upon when the complementary pasture is grazed. Thus, a complementary system can be a powerful range improvement tool.

A dividend of any improvement practice is the increased carrying capacity of cattle on range or the reduced costs involved in production. An improvement practice may not appear as the most economically sound alternative under one management system, but can become highly profitable when a complementary pasture system is developed.

In addition, the use of complementary pastures allows producers a better opportunity to take advantage of new technology in the field of animal science. Without a large supply of low cost forage, the increased milk production from better range cows, more rapid weight gaining ability of their calves, crossbreeding, etc., cannot be effectively implemented by range livestock producers. Also, complementary pastures give range producers the opportunity to have longer grazing periods when plants are nutritious, move animals off native range during periods when poisonous plants are hazardous, and develop flushing pastures, breeding pastures and green creep systems.

Crop Residues

Residues from cash crops often can be economically utilized in balanced grazing programs that combine use of cropland with range.

Corn and sorghum grains are the major crops contributing to residues that can complement range. Stalks from these crops furnish a considerable amount of pasture for cattle during the late fall and early winter months. Mature ruminants can make particularly good use of stalk, since their digestive systems are capable of handling large amounts of coarse roughage. But tops are used in many areas. Other crop residues such as wheat are often used for emergency feed.

Forage residues from stalk fields are successfully used to complement range forage in November and December. In areas where these crops can be successfully grown, they can provide the base for increasing carrying capacity and improving the profitability of the range operation. Stalks, however, are very low in protein, and may need to be supplemented. In the Great Plains this frequently is accomplished by free access to wheat pasture. However, if small grain pasture is not available, protein supplementation is no greater than would be required on the ranges where energy is being conserved for later use.

Small Grains

Small grains produce good yields of high quality forage at a season of the year when green grazing on ranges is limited. Winter pasturing of wheat grown primarily for grain has contributed significantly to range livestock production for many years in the Southern Great Plains Region. However, in the Northern Great Plains, wheat pasture is not a reliable source of forage more than three to five years in ten.

Livestock are removed from the major portion of wheat acreage in the spring in time to mature a grain crop. Other small grains, chiefly rye and oats, are utilized to complement range forage in the winter and spring months, without regard to grain production. Also, small grains supply an abundance of high quality protein which supplements range at a time when it is deficient in protein.

Small grains have significantly complemented range livestock production in all areas where they can be grown and are especially valuable for growing out and conditioning feeder calves before the calves go into feedlots.

DEMAND FOR RANGE

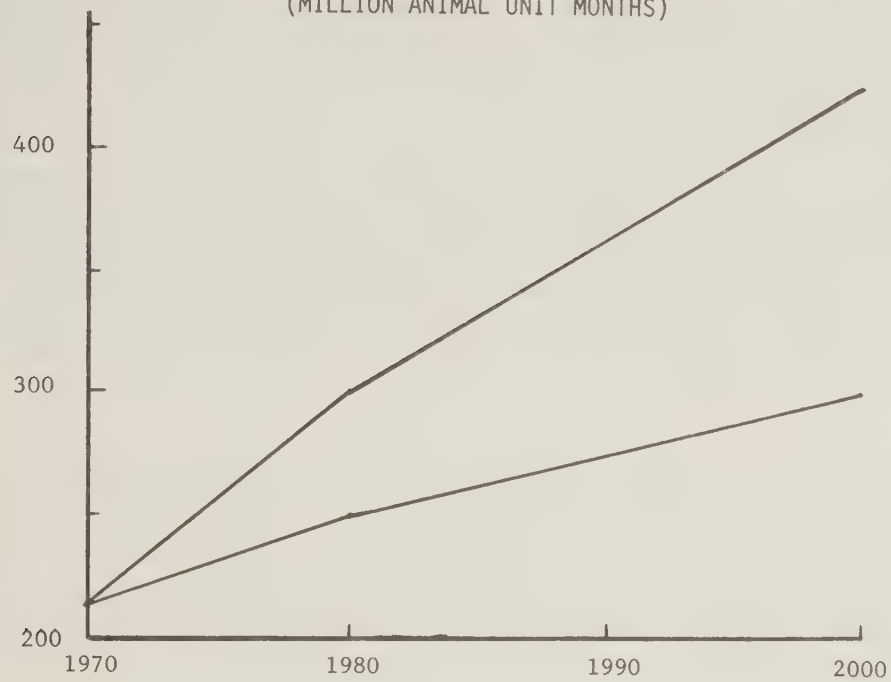
Indications are that domestic demand for meat, beef particularly, will continue to increase if producers can supply amounts adequate to keep prices reasonable. Furthermore, world demand for feed grains, soybeans, and for meat in the more highly developed countries, is expected to remain reasonably strong for the foreseeable future. This appears to indicate continued upward pressures on prices for agricultural commodities, particularly feed grains, protein feeds and livestock and livestock products.

The projected increased demand for red meat and grains, domestically and world-wide, indicates that the Nation will need substantial increases in forage production from ranges in the years ahead. However, higher prices for grains will result in some of the Nation's best forage lands being converted to grain or soybean production, a trend that has already begun. This should place even greater pressure on range. Moreover, high prices most likely will result in reduced levels of feeding grain to beef cattle. In addition, feeder cattle probably will be carried to heavier weights on forages before entering feedlots, reversing the trend of the past twenty years. Thus, while less forage land will be available, the range and other forage-producing areas remaining in forage production will be called upon to produce enough to compensate for land lost to crop production, plus the amount required in substituting forage for grain in ongoing cattle raising and/or fattening systems.

Interactions of complex factors have occurred recently to support these conclusions; including those of economic outlook, political and social; world markets for grain, vegetable protein and meat; breakthroughs, or lack of them, in animal and agronomic technology; changing price relationships; energy problems and fossil fuel shortages; and use of set-aside lands. These and related factors have been developed in the Section on Issues.

Given the changing nature of all these factors and resultant increases in demand for range, low and high range demand estimates have been developed. The actual demands could reasonably be expected to fall between the estimates. The low estimate is based primarily on long term trends as evidenced in the historical data. The high estimate includes revision of factors influenced by recent events, including the recent impacts of inflation, international monetary markets, energy crisis, and world food supplies and needs. (Figure 1)

Figure 1.--Estimated limits of demand for range to year 2000
(MILLION ANIMAL UNIT MONTHS)



The projections are aimed at year 1985 primarily but are also extended to year 2000. (Appendix tables 2 and 3) The longer time frame is necessary in an evaluation of range because of the extended time between installation of facilities and revegetation and other improvement programs and the production response of the land. Some of the factors assumed are common to both high and low values. A single medium low population projection is used (Bureau of Census, Series E). The same projection levels of general economic factors of population, gross national product (GNP), disposable income, etc., are used in both demand levels. Also common to both demand levels are such range-related factors as amount of land available for range-related factors as amount of land available for range and/or other uses.

Food prices, livestock feed prices, per capita meat consumption, exports of feed grains and meat, imports of meat, and livestock feed mixes vary between the two demand levels.

A critical factor in the estimation of the need for range relates to the final consumer preference for beef and lamb. Since 1950 there has been a continuing and rapid increase in the consumption of total meats in the United States, while during the 1960's the preference for beef over other meats grew sharply. Considering that the per capita consumption of lamb declined during this period, the projections of domestic per capita consumption of beef assumes a higher level, while per capita consumptions of lamb assumes a lower level through 1985 and 2000.

The lower per capita consumption projection assumes that consumer prices of beef will hold near 1972 levels relative to personal disposable income and therefore is a result of increased population and small net imports. The higher per capita projection of beef consumption assumes beef prices at slightly higher absolute levels, but lower relative to other foods, and a stronger consumer preference for beef.

Per capita consumption of lamb is projected to continue to decline in both high and low projections. Primarily a function of consumer preference, the rate of decline will be modified by relative prices. In any event, the magnitude of the total quantity of beef consumed is such that relatively minor changes in beef consumption negates changes in lamb and mutton consumption in terms of impact on livestock feed supplies and on the utilization of ranges for grazing.

LOW DEMAND ESTIMATE

The low demand estimate is based on values which would lead to the lowest, reasonable estimate of demand. It results in an anticipated increase in range grazing requirements of 18 percent by 1980 and another 6 percent by year 1985.

If this estimate is to be valid, many of the economic, technological and attitudinal events of the last 3 years must be considered as temporary. By 1980, therefore, the trends and levels of activity would return to a pattern consistent with the 1970 period and earlier.

HIGH DEMAND ESTIMATE

The high demand estimate reflects two major groups of factors which would increase the demand for range grazing.

The first is an assumption of a continuing and increasing preference for beef in the domestic food consumption pattern. Thus the per capita consumption of beef continues to increase in spite of increases in beef prices levels relative to other foods, and increases in general food prices levels relative to the 1950-1970 period. The

increased consumption of beef in a higher price situation is possible since the projection of increased personal income permits a higher absolute quantity of dollars flowing to food items.

The second is a group of factors including relative prices of livestock feeds, increased exports of agricultural products (grains and soybeans) and increased productions costs for grains resulting from higher prices for energy. The accumulative effect of this group of factors under the assumptions used is to reduce the quantity of non-grazed feeds available for livestock and to increase their price. The relative value of grazing increases in response to the overall demand for livestock products and the quantity of beef produced in feedlots will return to 1960-1970 levels of 25 percent. Under these assumptions, demand for range increases 40 percent by 1980 and 55 percent by 1985.

IMPORTANT ISSUES AND FACTORS THAT MAY AFFECT CURRENT AND PROSPECTIVE DEMANDS FOR RANGE

Demand for range is related to many domestic and World issues. Population growth, energy requirements, balance of payments deficits, increasing World markets for meat are among these issues.

Current information and thought about these issues have been assembled and related to the question of demand for range in the pages that follow.

A recurring issue related to livestock production is land set aside from crop production under cotton, feedgrain and wheat programs. The set-aside, amounting to 58.8 million acres in 1972, has been tied to the needs for decreasing supplies of these commodities. In consideration of current and anticipated export demands and domestic needs, set-aside acreages have been released for crop production. Should supplies of the basic commodities catch up with demand, set-aside lands could come out of crop production and, if the producers are authorized, could produce considerable forage.

ECONOMIC OUTLOOK, POLITICAL-SOCIAL FACTORS

Recently the economy has been trying to expand at a faster pace than available natural resources would permit. This has shown up in either sharply rising prices or absolute shortages of products derived directly from forestry, agriculture, minerals and metals, and especially to energy from oil. For the past twenty years prices of products derived from natural resources have been falling relative to prices in the rest of the economy. Now the basic question concerns whether or not the economy is entering a period of several years when these resources will become increasingly scarce.

Such scarcities, particularly in fossil fuel come at a time when policy makers are looking to agriculture and other raw material segments of the economy to ease the balance of payments deficit. While the 1972-73 export levels may have constituted a temporary situation, expectations are that a very high level of agricultural exports can be maintained. An increasing scale of balance of payments deficits will result from short supplies of oil and other strategic minerals (bauxite, chrome, copper, etc.). These deficits would in turn generate increased pressures to export greater quantities of agricultural commodities. A trade surplus in agriculture is desirable as it goes far in stabilizing the dollar, strengthening the nation's posture in international trade, and helping pay for much needed oil and consumer goods that add to the level of national affluence.

This represents a change from the time after World War II, when the main role of U.S. agriculture in foreign affairs was to provide the food aid that offered devastated countries a measure of stability while economies were rebuilt and governments restored. Now, economies in much of the world are strong and growing and with some painful exceptions, the international role of U.S. agriculture, as the world's leading supplier of a number of basic agricultural commodities has changed from one primarily of aid to one of trade. The United States, thus, assumes the role of providing for a higher standard of living to foreign societies, rather than survival, which it did so well with the massive food aid of the forties and fifties.

Furthermore, the new direction in U.S.-Soviet relations was preceded by overtures in the field of agricultural trade. Virtually all of the trade that has resulted from the Nation's new relationship with the People's Republic of China has been agricultural trade.

In order to fulfill the nation's desires for expanding international trade in basic agricultural commodities such as wheat, feed grains, and cotton, and quite possibly in animal protein, more attention must be paid first to increasing the production of feed grains or reducing the relative contribution of higher priced feed grains to the final meat products; second, to increasing beef cow numbers and/or productivity per cow. Both strategies call for increasing the productivity and utilization of the vast acreages of ranges, for cropland pastures and other forage crops likely will be converted increasingly to feed grains.

CHANGING PRICE RELATIONSHIPS

While the total picture appears to indicate considerably increased demand for red meat, principally beef, the higher demands for, and costs of, feed and food grains probably will mean a higher dependence of the beef industry on forage, particularly that from range. This should occur even while some forage producing lands are being converted to grain production. Unless more beef cows are available, however, and unless they secure more of their energy needs from forage, beef supplies in the long run will remain below demand and prices to consumers will remain high and probably increase further. What happens with respect to prices of feed grains and soybeans will have minor effects on this situation.

Nevertheless, the increased relative prices of feed grains and protein supplements could result in a reversal of the trend toward more concentrates in livestock rations. In the early forties, concentrates amounted to only about 14 percent of the feed unit intake of beef cattle and by 1970 this percentage had increased to 24 percent. During this time the proportions of concentrates and forages in livestock rations followed their relative prices, with the price of corn relative to the price of hay falling throughout most of the period for which the increased feeding of concentrates has occurred.

The increased reliance on concentrates comes from two sources: (a) the increased prevalence of fed beef relative to non-fed beef, (b) the feeding of "hot" rations to beef cattle at lighter weights (Skold, 1974). Fed beef accounted for 78 percent of all beef in 1970, but only 45 percent during the early fifties. In the past, cattle weighed 800 to 900 pounds and were often two-years old before they were placed on feed concentrates. Increasingly, younger and lighter animals have been placed on feed and the amount of concentrates fed per pound of beef produced has increased.

Forage requirements increase greatly as animals are kept out of the feedlot until they are heavier and older. An 800 pound animal consumes over two and one-half times as much forage as a 425-pound animal. The forage requirement per pound of live weight beef produced increases from 3.3 pounds for the 425-pound animal to 6.2 pounds per pound of gain for the 625-pound feeder, and up to 7.6 pounds for an 800 pound animal.

If the price ratio of grains (concentrates) to forage is higher in the years ahead than has been the case over the past two decades, greater use of forage will have to be made in order to meet the growing demand for beef production.

There are several kinds of adjustments which may occur as a result of the expected continuance of higher prices for feed concentrates. First, more forage may be substituted in rations of cattle being fattened, particularly if the cattle to be fed continue to be started into the fattening process at lighter weights. This would place a higher demand on cropland forage. Second, cattle feeders could place cattle on feed at heavier weights, with the result that increased forage demands would be placed on both cropland forages and range. Thirdly, the movement toward "grass-fat" cattle as a system may become a reality if the prices of feed grains became exceptionally high.

While grass-fat beef is as nutritious as grain-fed beef (even more acceptable from the standpoint of low-fat diets) consumers are not likely to readily accept it. Current grading standards and the terms "prime" and "choice" have conditioned the consumer to favor grain-fed beef. Some combination of changes in grading, terminology, education and pricing at both slaughter and retail levels will be required to increase the marketability of grass-fat beef. This type of adjustment would increase the relative demand for pasture and range while reducing the relative demand for feed-grains. The feasibility of this adjustment is improved if the capability of the range is developed to its full economic potential.

WORLD MARKETS FOR GRAIN, VEGETABLE PROTEINS, AND MEAT

Domestic supplies and prices of meat are related not only to the world effective demand for the meat produced, but also in a larger measure to the effective foreign demands for feed grains, vegetable proteins, and other basic commodities that compete with feed and forage supplies for domestic livestock. While prospects are that increased U.S. exports of grain and vegetable proteins will result in increased domestic prices for these products, creating the need to alter existing systems of meat production, a close examination is needed of the interrelated factors (Cothern, 1974).

Measurement of world effective demand for grain, vegetable proteins and meat is especially difficult now because of the emergence of Red China and Russia as trading powers, unrelenting international inflation and the presence of a worldwide energy shortage. Population growth, another key food consumption variable, is difficult to measure using historical bases because of the impact of birth control measures on population growth around the world.

Ability of the developing countries to supply individuals with food needs beyond mere subsistence is also a matter of current grave concern. Food production per capita has increased rather rapidly in the economically mature countries--about 1.5 percent compounded annually as compared to 0.4 percent in the lesser developed countries. Production in these latter countries has barely kept ahead of population growth.

Several events occurred in 1972 which influenced the delicate food and feed grain supply-demand balance. First, a worldwide drought occurred which resulted in an absolute decline of 4 percent in world food production. The most notable failure occurred in Russia which had a shortfall of 13 million tons of feed grains. Indian, Australian, and Southeast Asian grain crops were also down. Second, the Peruvian anchovy catch failed. This caused soybean prices to sky-rocket, and pressures on other high-protein feed sources. Third, the cold war thawed between the United States, Russia and Red China. This "detente" resulted in export sales of over $900 million of feed and food grain to Russia in 1972 as compared to $131 million in 1971 and $200 million to China as compared to nothing the year previously. The effect of these sales essentially eliminated United States feed grain reserves which had been dwindling for a decade. Fourth, balance of payments difficulties resulted in the decision to devalue the U.S. dollar. The composite effect of these devaluations was to make agricultural commodities much cheaper to foreign buyers--particularly to those who hold dollars. Grain sorghums were about 17 percent cheaper and soybeans about 18 percent less. In the aggregate, all agricultural commodities were devalued about 9.5 percent (Farrell, 1973).

As a result of these events, and despite a considerable increase in the 1974 Peruvian anchovy catch, U.S. agricultural exports are expected to total about $19 billion for the fiscal year ending June 30, 1974. While Russia has not made 1973-74 purchases of the size of 1972 acquisitions, other countries have more than offset this reduction. As a result, 1974 feed grain carryover apparently will be the lowest in over twenty-five years. Added to this is the prospect of high demands upon U.S. wheat to help alleviate starvation in India and drought-stricken Africa.

The ability of domestic and international feed grain producers to supply livestock feed and other feed uses is being tested. Excess idle cropland acres have been reduced to negligible amounts. Creation of surpluses in perhaps two or three years has been projected by some analysts while others expect international demand for feed grains will continue to outstrip supply. Moderately priced feed grains mean accelerated livestock production capabilities, while high priced feed grain policies with no increase in cropland and range forage production will inhibit expansion of meat production. This is especially the case in those industries (feedlots) that have substituted cereals for roughages and in the process have shortened the time period necessary for finishing cattle to slaughter weights.

Possible trade levels for U.S. agricultural commodities have been estimated by Economic Research Service using two sets of assumptions; one set a continuation, more or less, of present policies among trading nations; the other set considering negotiations for trade demand for livestock products (Rojko, 1973). The two levels of export values projected are based on alternative assumed rates of inflation.

Under the first alternative--the continuation of present policies--U.S. exports of feed grains are seen to increase from 20.9 million metric ton base to 56.3 million metric tons by 1985, and soybean exports could increase from 11.6 million metric tons to 30.6 million metric tons.

Continued rapid economic growth in the major world economies will expand the demand for meat in general and for beef in particular throughout the world. World meat consumption (and production) is expected to reach 163 million metric tons by 1985, expanding annually by 2.9 percent. This figure includes 59 million metric tons of beef. If trends of the past decade continue, short-falls in the supply of beef could prevail both in the economically developed countries and in centrally planned countries by 1980.

FOSSIL FUEL ENERGY

With 6 percent of the world's population, the United States uses over one-third of the world's energy. Roughly 85 percent of the energy used in the United States is available from domestic sources, while the balance is derived from imported oil. Lack of production and refining capacities at home and the Arab oil boycott in early 1974 combined to create energy shortages in all segments of the economy.

For the next decade at least, the era of abundant, inexpensive energy has passed, and while agriculture most likely will receive top priority in the allocation of scarce fuels, fossil fuel costs will no doubt create a need in some situations for the substitution of low energy using production activities for those of high energy use.

Current meat production systems require high inputs of fossil fuel energy applied indirectly through feed grains. At the present time, feed grains constitute the highest proportion of total livestock feed requirements in history. This increase in feeding of grain, added to the fact that more cattle are being fed have resulted also in the highest inputs ever in fuel energy applied to cattle directly through feed grains.

Increased development and utilization of range for livestock production can reduce the drainage on future national energy requirements for meat animals. About 10 pounds of high quality range forage will convert to a pound of steer gain. About 26 pounds of high quality forage are required per pound of calf gain and 22 pounds of forage per pound of lamb gain. Steers fed a formulated ration under confinement would require about 100 megacals of fossil fuel to produce a pound of gain, whereas, the fossil fuel expenditure per pound of livestock weight gain on range is negligible.

Cattle ranches in the southwest, for instance, used approximately 4 gallons of gasoline and 62 kilowatt hours of electricity to produce 100 pounds of beef on the hoof in 1974 (CAST, 1974). If range cattle production were shifted from grazing to feeding a ration of 20 pounds of alfalfa hay per day, fossil fuel requirements would double, and requirements of electrical energy would increase about 50 percent. In 1969, livestock ranches in the United States spent 2.8 cents for fossil fuels per dollar of product sold. If harvested feed grains were substituted for grazing from ranges, they would cost more than twice as much in fossil fuels.

Demands for range grazing in production of wool and mohair, though now relatively minor compared with cattle production demands, may increase as the costs of producing petroleum-based synthetic fibers increase. Thus, wool and mohair have an opportunity to recapture a portion of lost apparel and fabric markets.

Fertilizer production is embroiled in the current and continuing shortage of natural gas needed to produce basic nitrogenous fertilizer material. Fertilizer usage in range livestock production is relatively small, but if additional harvested cropland forages and grains were needed to supplement forage grazed from range and these cropland acreages continue giving way to cash crops, more fertilizer would be required to increase yields. Such a shift of livestock production from range to cropland, as in the case of high fertilizer use in grain production, would aggravate the shortage, resulting in higher prices for fertilizers.

On the other hand, energy shortages and resultant higher prices for specified inputs will work a hardship on range improvement. Revegetation, brush control and fertilizer use in the areas of adequate precipitation, will be affected particularly in that the costs of increasing grazing capacities on lands requiring these treatments will be higher than anticipated. As a consequence, some of the low energy-using range improvement practices will be substituted for these higher energy-using practices.

SCIENTIFIC BREAKTHROUGHS

The demands for range will be influenced greatly in the long-run (beyond 1985) by scientific breakthroughs in animal, meat, meat substitutes and analogs, fiber, range and agronomic technologies. For this analysis, however, the assumption was made that scientific breakthroughs would have only minimal effects to 1985. If adopted in any large measure by producers and manufacturers, these technologies could have a considerable impact upon resulting supplies of livestock.

Many animal scientists, recognizing that the beef cattle industry has not experienced the revolutionary changes that have characterized other segments of agriculture, have expected greater opportunities for increasing beef output through vertical expansion--increasing the output per production unit, the cow. Among the methods for improving cow-calf management systems and overall herd efficiency are: crossbreeding, with up to 20 percent improvement over pure line breeding possible; artificial insemination, thus reducing the total number of bulls and increasing the use of performance tested bulls; induced twinning, with a possible expectation of 160 percent calf crops; control of estrus cycle, with calving occurring at the most advantageous times for the producer and at increased calving rates; control of sex, where only cows from which replacement heifers are desired being bred to produce heifers; and early weaning of calves.

On the plant side, including range and agronomy, research findings have been used to increase both the number of animals that can be grazed and meat output per animal. Treatments and associated technologies applied include forage varieties for renovation or feed supplementation that yield more and have higher quality forage, and grazing systems that result in improved efficiency of forage production and harvest. Other management practices include proper stocking and improvements, such as fencing, stock water developments, brush and noxious weed control, seeding, water spreading and drainage, fertilization, prescribed burning, timber thinning, and rodent, insect and disease control. By no means a complete listing, more than one of these practices may be used in conjunction with another to increase quantities and qualities of forage produced on range ecosystems.

Beef cattle industry experts have indicated that during the 1970's the major addition to the supply of domestic beef is expected to come from a greater number of beef cows. This increase would come largely as a result of more intensive practices such as planned grazing systems applied to cropland and range forage production and utilization (van Arsdall and Skold, 1973).

Technologies outside the realm of livestock production constitute a large and growing body of synthetics and substitutes which could affect rather significantly the demand for meat and consequently rangeland produced forages. Although synthetics and substitutes will not cause major adjustment problems for agriculture in the seventies, they probably will continue to replace portions of red meat and natural fibers that would otherwise be consumed or used during this period and into the eighties (Gallimore, 1972).

The major penetration of the red meat market is in processed items where soy protein extenders replace part of the meat, the major incentive for their use being the reduction in costs of processed items to the consumer. The number of meat animals and the amount of range needed to supply meat for processed items would be reduced by each level of market penetration for soy protein. Another area of substitution would be the use of meat analogs, the material usually prepared from vegetable protein to resemble specific meats in texture, flavor and color. Also, not to be overlooked is the direct substitution of vegetable and dairy products for meat. Increased consumption of these products would have similar effects on the number of meat animals required, but in the case of dairy products could require increases in milk yields or increased milk cow numbers, resulting in a demand for more forage.

Increased soybean prices of late and the expectations for continued price levels exceeding those of the early seventies because of export demands may mitigate against a rapid upswing in using soy protein as meat extenders and meat substitutes. Another factor in this regard is the higher processing costs, including those of labor and fuel. The direct consumption of dry beans and corn as direct substitutes for meat is tied up with long-term consumer preference trends favoring meat, the continued demand for corn for export and livestock feed, and the lagging technology that has kept dry bean yields at rather low levels. High concentrate feed costs will mean higher costs for dairy products and could restrict the degree to which they will be consumed in lieu of beef.

Natural fibers, wool and mohair in this consideration, have long faced a losing battle in competition from synthetic products. Included in this context is the substitution of synthetic products for hides and skins. The petroleum products used in these synthetic substitutes have suffered increasing prices and increased processing costs associated also with the shortage of fossil fuel. With energy prices expected to continue at high levels, and with some evidence of consumer preferences returning somewhat to natural products, there is reason to assume that wool, mohair and hides and skins will perhaps capture a portion of their lost markets. Thus, ranges may well experience increasing pressure from sheep and goat grazing as wool and mohair prices rise.

OPTIONAL USES

Use of range ecosystems for livestock, meat and fiber production often is influenced by the presence of other options resulting from physical and biological possibilities that are deemed desirable or important from private and/or public standpoints as related to a wide range of goals, services desired and values. These options include, depending upon specific ecosystems, timber production, watershed protection, wildlife habitat, scenic beauty and recreation.

Since 1950 there has been a continual reduction in the quantity of land available for agricultural and forestry uses. Land withdrawn from food and timber production is now in urban, transportation, recreation, parks, wilderness, wildlife areas, national defense, industrial, public installations and facility uses. This trend in reduction in land resources available for agricultural purposes is expected to continue. Special uses of land increased by 27 percent during the 1959-69 period (Frey, 1973).

In 1974, for the first time in over 20 years, almost no land is idled from crop production by commodity programs (Skold, 1974). Thus, another prospective source of livestock feeds is no longer available for consideration as a means of increasing livestock production above current levels. Further reduction in land available for grazing can be expected as cropland pasture is converted to cereal and feed grain production (Skold, 1974). Overall, an increased demand for land for non-livestock purposes can be expected and the increased demand for red meat will have to be met with production from a shrinking land base (Box,1974).

Alternatively, not all land throughout the nation that has a potential for grazing use has been developed for grazing. Areas in the humid eastern portions of the United States have an undeveloped potential which can be added to the resources used for grazing without significant reduction in other production activities.

In the Great Plains and western range areas grazing has been developed on almost all of the land available. Most of the land resources of the western range are of limited value to uses other than grazing, timber production, wildlife habitat, and watershed protection. The Great Plains, however, have numerous cropping alternatives.

Nevertheless, in the western range area and in much of the Great Plains, range is a primary livestock feed source and the opportunity for additional production is through intensification of management and use of the existing range resource.

Range ecosystems produce forage much of which has no economic possibility for harvest except through grazing by ruminant animals, cattle and sheep primarily. Increased reliance for forages and other feeds from sources other than range ecosystems results usually in higher costs of production, given current and expected prices of basic agricultural commodities.

Much of the ruminant livestock production cycle is tied to two essential aspects of range--space and relatively low cost feed. Breeding herds must subsist and reproduce and, given winter supplemental feeding on concentrates and hay, range ecosystems provide this opportunity. If ranges are not fully utilized, especially during periods of high feed grain prices, the supply of meat, largely related to the size of breeding herds, would decline.

Properly managed, most range ecosystems can be grazed without undue stress on such alternative uses as watershed protection, wildlife habitat, timber production, and recreation. In the range of competitive relationships between or among these uses, product prices and rates of substitution would allocate the uses of ranges to the most profitable arrangement. To a large degree these uses may be complementary or supplementary, resulting in situations where multiple uses have a place, with no one specific use detracting economically from returns from the other use or uses.

RANGE SUPPLY-CURRENT AND POTENTIAL

In the sections that follow, range will be discussed within its full scope as defined earlier in this report. Thus, rangelands, many forest lands, and grazeable woodlands all are covered. Additionally, forest lands managed as native pasture are included.

THE CURRENT RANGE SITUATION

Information about the range is available from many sources. Publications provide facts about range and its production in specific areas in association with research or management discussions and actions. Numerous agencies and individuals have assembled range information for the interests and areas within their jurisdictions and authorities. Some information sources are local; others State or regional; others National. The information base for range as used in this report is a synthesis of most of this published and available non-published information as presented in The Nation's Range Resources--a Forest-Range Environmental Study (USDA, FS, 1972).

The Range Base

Approximately 63 percent, or 1.2 billion acres of the first 48 States is either forest or rangeland (Table 1). Sixty-nine percent is in non-federal ownership. Of the 1.2 billion acres, 419 million acres are classified as western rangeland--ecosystems with native grass or shrub cover located principally in the 11 Western States. An additional 229 million acres of rangeland is situated in the Great Plains States from eastern Montana and North Dakota, south into Texas. Thus, 648 million acres of land, or 56 percent of the 1,160 million acres in the 17 States westward from the Great Plains is rangeland.

Table 1.--Forest and rangeland by ecogroup and ownership, 1970

(million acres)

Ecogroup	National Forest System	Other Federal Lands	Non-Federal Lands	Forest-Range Environment
Western Rangeland	51.6	178.8	188.2	418.6
Western Forest	87.1	11.9	61.7	160.6
Great Plains Rangeland	3.9	7.1	217.9	228.9
Eastern Forest	23.3	9.0	361.1	393.5
48 State Total	165.9	206.8	828.9	1,201.6
(Percent)	(14)	(17)	(69)	(100)

Data Source: USDA, Forest Service, Forest Resources Report No. 19

Grazing of livestock in forests has been a common practice for many years. Ranchers and farmers have found many forest areas produce forage that meets livestock needs. This grazing frequently complements forage from rangelands or other feed or forage sources. Many satisfactory systems of forest grazing are in use.

Livestock graze more than 250 million acres of the 554 million acres of forest in the U. S. (Tables 1 and 2). Of the 394 million acres of Eastern Forest, approximately 160 million acres is grazed. Livestock also graze upon 97 million acres of the 161 million acres in the Western Forest. All told, livestock graze upon approximately 835 million acres of the 1,201 million acres of forest and rangeland ecosystems throughout the 48 states.

Table 2.--Rangeland and forest grazed, by ecogroup and ownership, and rangeland and forest ungrazed, by ownership, 1970

(million acres)

Ecogroup	National Forest System	Other Federal Lands	Non-Federal Lands	All Ownership
Western Rangeland	36.6	154.5	169.8	360.8
Western Forest	56.9	4.1	36.2	97.2
Great Plains Rangeland	3.4	5.8	208.0	217.1
Eastern Forest	3.6	.2	155.9	159.8
Total Grazed	100.5	164.7	569.8	835.0
Total Ungrazed	65.4	42.1	259.1	366.6
Grand Total	165.9	206.8	828.9	1,201.6

Data Source: USDA, Forest Service, Forest Resources Report No. 19

In 1970, it was estimated that only 28 percent of all rangeland in the West and in the Great Plains was in good or better condition (Table 3). That is, only 184 million of 648 million acres exhibited vegetative cover of desirable amount and kind in relation to its potential. On the remaining 464 million acres, the vegetation had deteriorated in amount and kind to levels less than good. About 24 percent of the rangeland was in poor condition.

Table 3.--Condition of the rangeland, 1970

(non-forest ecosystems only)

Ecogroup	(million acres)			
	Good	Fair	Poor	Total
Western Rangeland	73.8	209.4	135.4	418.6
Great Plains Rangeland	110.6	102.8	15.5	228.9
Total	184.4	312.2	150.9	647.5
(Percent)	(28)	(48)	(24)	(100)

Data Source: USDA, Forest Service, Forest Resource Report No. 19

Estimates of rangeland condition in the Plains States of North Dakota, South Dakota, Nebraska and Kansas in 1974 indicated that 66-percent of the non-Federal rangeland was in good or excellent condition (SCS data, Midwest Technical Center--1974). On 134 million acres of non-Federal rangeland in the Southern Plains and Southeastern States, the 1974 condition is estimated at good or excellent upon 53 million acres; fair upon 54 million acres; and poor upon 27 million acres (SCS data, 1974).

Of the 160 million acres of Eastern Forests grazed in 1970, 72 million acres were being grazed exploitatively (USDA, Forest Service, 1972). That is, the forest cover, soil, or other environmental values were being deteriorated because of poor management of livestock. Exploitative grazing also occurs on about 10 million acres of Western Rangelands, with lesser amounts in the Western Forests and Great Plains Rangeland.

Outputs--1970

The primary production use value of rangeland is livestock grazing and, thus, grazing is its principal output. However, rangeland has many other uses than livestock grazing as this report has discussed elsewhere and demands for some of them are increasing rapidly. Briefly summarized here are outputs of grazing and non-grazing resource values.

Livestock Grazing

Production of grazing approximated 213 million animal unit months in 1970 (Table 4). This is the equivalent of supplying the yearlong forage requirements for about 17 million cows, which is about 45 percent of the beef cow population for that year. Of this, the Western Rangelands and Great Plains Rangelands produced 149 million animal unit months, or 70 percent. Forests produced 30 percent of the animal unit months--a sizeable 64 million AUM's--with the Eastern Forests producing almost as much grazing as the Western Rangelands.

Table 4.--Production of grazing (animal unit months) by ownership and ecogroup, 1970

(Thousand AUM's)

Ecogroup	National Forest System	Other Federal Lands	Non-Federal Lands	All Ownerships
Western Rangeland	5,696	15,551	34,834	56,081
Western Forest	3,334	594	6,801	10,729
Great Plains	1,161	2,465	89,140	92,767
Eastern Forest	1,064	147	52,314	53,525
Total	11,255	18,757	183,090	213,102
(Percent)	(5)	(9)	(86)	(100)

Data Source: USDA, Forest Service, Forest Resource Report No. 19

The bulk of the grazing comes from non-Federal lands. Of the 213 million animal unit months produced in 1970, only 14 percent came from the Federal lands, with 86 percent from the non-Federal sector.

Non-livestock Outputs

Among the many non-livestock outputs are water, wildlife, natural beauty, air quality and cultural heritage. In 1970, Western Rangeland ecosystems yielded an average of about 0.24 acre feet of

water per acre, essentially all of which was of acceptable quality (USDA, Forest Service, 1972). Storm runoff, another measurable output from range, averaged about 0.32 inches per acre, while sediment from Western Rangeland ecosystems approximated 2.74 tons per acre. When measured on a quality (goodness) scale of 5 to 1 (with 5 being "excellent" and 1 being "bad") natural beauty, air quality, and cultural heritage values ranked "fair" to "good" in Western Rangeland ecosystems. Wildlife values, expressed in non-game birds, carnivores and raptors, rare species and hunting, were quite variable in quality, ecosystem by ecosystem. Generally, these qualitative outputs rated fair. A notable exception was in mountain meadows and annual grasslands where range management being applied in 1970 resulted in "poor" quality as related to rare animal species.

POTENTIAL OF RANGE TO MEET PROJECTED DEMAND

The Nation's ranges have ample capability to produce the additional forage needed to meet estimated future demands for livestock grazing. This increased production capacity can be developed by adding facilities and improved management to the existing level of developments. The dollar cost and the impact on the environment of increased production through additional inputs vary widely from one area to the other.

Productivity Under Alternative Management Levels

The productivity capability of the range is fully adequate to meet the highest projected demand for grazing in year 2000 (426 million AUM's per year) at competitive cost. Range, as a source of livestock feeds, remains competitive at the high demand levels and in the face of increasing cost for range facilities because the implications of recent events cause marked increases in costs of alternative feed sources. If the per capita consumption of beef, the export of feed grains and the increased price and shortage of fuels continue on the trends of the last three years, the competitive cost position of range may even improve at the higher demand levels.

In developing both low and high estimates of production needed to meet range demands, certain assumptions become necessary regarding levels of technology applied.

On the range and agronomic side, only those range improvement practices that could be, or that are being applied under presently known and available levels of technology are used. It is assumed that no breakthrough will occur in brush control--either chemical or mechanical--seeding, fencing, water development, and the like. It should be noted, however, that if herbicides used in brush and noxious

weed control are restricted or eliminated because of current environmental factors, production and costs would be affected. In the application of additional range improvement policies, the new and more intensive bundles of practices for a particular ecosystem means that higher management levels must be applied than are currently in effect.

On the animal side, it is assumed that no material changes in animal technology will take place. That is, no change is expected in the efficiency of forage grazing as related to the animal itself, but rather use is made of livestock management systems that would facilitate better distribution of livestock on the range, and more appropriate timing of grazing. In this respect, a higher level of management is necessary to achieve the additional grazing resulting from investments in range ecosystems.

The 1.2 billion acres of all forests and rangelands is estimated to have a total AUM production capacity that could vary from 184 million to a high of 1,700 million, given 25 years of development, under a program geared to long-term, sustained commitment.

The 184 million AUM estimate is predicated upon grazing livestock under control but with no attempt to develop the untapped potential via range improvements and high order management. The 1,700 million AUM estimate,on the other hand, would result only from maximizing livestock output upon a large portion of forest areas as well as rangelands.

The production of 1,700 million AUM's is over eight times current production (an estimated 213 million AUM's) and 4 to 5 times the probable quantity demanded. The extreme high represented by this estimate is not an acceptable measure of real capacity, since the achievement of that level of output is very expensive in terms of environmental impact and in the reduction of other outputs now produced by the same land. This high level of production cannot be achieved in a multiple-use context but must sacrifice other production values in favor of livestock grazing.

A more realistic estimate of physical production potential is represented by applying intensive environmental and livestock management to each acre of the total available range area. This would result in a production level of 566 million AUM's and could be achieved within the multiple use context. Again, the cost per AUM would be relatively high, over $4.74 per AUM and result in a supply level that exceeds estimated demands. However, the application of intensive management to all land also denies the existence of differences in the relative capability of the many range ecosystems as well as the differences in productivity from site to site within an ecosystem.

Independent 1974 estimates by the Soil Conservation Service of the potential production capability by 1985 are for a realistic increase of 50-percent in the Southern and Southeastern States. (Unpublished data--SCS, 1974) These estimates do not include specific cost limitations nor total physical production capability. The increase possible by 1985 represents only one-fourth of the total physical capability estimated to be available.

Estimating Efficient Supply Opportunities

Uniform application of a single intensity of management or management strategy on all kinds of vegetation types, soil types, and conditions is not economically realistic. Areas with differing capabilities will vary widely in their responses to uniform treatment and thus in production costs. The benefits received from intensive management on some areas will not be commensurate with the costs. On the other hand, land with high productive capacity is inefficiently used if a minimum level of management is applied and the capacity to produce is not developed. The application of a single strategy of management to all land, thus, either results in more commodity output (grazing) than needed or in less environmental and associated values than desired, or in higher costs than can be justified.

It follows that a more efficient approach is to selectively apply management intensity to each area in accordance with its estimated ability to produce and in relation to production costs. This is the approach used in deriving the estimates in Table (See Appendix E for detailed explanation.)

Supply and Cost

Using the concepts discussed in the previous sections and as detailed in Appendix E, attainable levels of production have been estimated (Table 5). The production opportunities are conditional to meeting the following national criteria.

1. Total wood growth, water yield, and quality water yield would be equal to or exceed the 1970 level.

2. Total sediment (in stream channels) would be equal to or less than the 1970 level.

3. Not more than five percent per year change is permitted in the historical grazing pattern.

4. No more than two percent per year of the land not grazed in 1970 will be grazed in the next 25 years.

5. Maximizing for livestock production in the absence of multiple

use is not allowed on Federal lands or on non-Federal forested ecosystems.

Table 5.--Alternative production of grazing (AUM's) from all Range, and costs per AUM

Alternative Quantities of AUM's Produced (Millions)	Land Investment Cost (per AUM Per Year) (Dollars)
200	3.04
300	3.22
320	3.26
360	3.34
400	3.42
425	3.46
560	3.72

The Table 5 production levels at the indicated cost per unit are possible. In each case the other outputs and the environmental quality variables remain constant, however. The higher production results from adding facilities and management to the appropriate resource or land units in accordance with their capabilities. The costs per unit of grazing increase not only because of added inputs needed to increase AUM production. Part of the higher costs is due to the requirements for maintaining environmental quality and related outputs. As indicated in the section of this report on range use, management across the country is not in all cases satisfactory and some resources are being adversely affected. Current grazing in some cases is being produced at an adverse cost to other resources. Adjusting management to fully protect those resources will result in higher costs of grazing.

Relating Supply Opportunities and Demand Levels

The scope of production opportunities exceeds the scope of demand estimates. Estimates of supply, then, indicate it is possible to meet the anticipated increasing demands from range. Either the

high demand level (426 million AUM's) or the low demand level (300 million AUM's) can be met, although the higher level of demand comes at a higher cost per unit of output.

The costs vary from about $3.00 to $3.72 per AUM, while production varies from 200 million to 560 million AUM's. By doubling the total range production with only a 15 percent increase in costs per unit of output (AUM), it becomes apparent that the higher levels of demand can be met at a competitive cost level.

Total land investment cost for production of 213 million AUM's in 1970 was about $860 million. The 300 million AUM level would cost $970 million and the 400 million AUM level costs $1,400 million for increases of 13 and 63 percent.

The cost of increasing production is determined by successive selection of the land resource unit at the next higher cost until the level of output desired is reached. It is an effective measure of the costs of additional production.

The current level of production (213 million), which costs about $4.00 per AUM, can be achieved for about $3.00 per AUM with more efficient grazing management, including the full application of current available technology to range.

Therefore, two steps are required to achieve the supply levels at the indicated costs. First, the improvement of management on land now grazed, and the application of more intensive management and improvements where it is justified both by expected production response and related costs. This will include development of grazing on some lands not now grazed, primarily in the more humid Northwest, and the South and Southeast sections of the United States.

Production opportunities by group of ecosystems vary widely because of different levels of response to added investment in the range and the different levels of development already in place.

For example, when total production is increased from 213 million AUM's (the current level), to 320 million AUM's--a 50 percent increase--the location of the new production varies by area (Table 6).

Grazing in Eastern Forest ecosystems would more than double with lesser increase in the three other ecogroups. This major shift in grazing production would occur largely due to the large underdeveloped potential of relatively low cost grazing in Eastern forest ecosystems.

These shifts are estimated to occur under the constraints of a national grazing program geared towards maximum efficiency in production of range grazing. However, the production indicated does not in all cases represent the potential for added production. For example, the potential exists in the Great Plains for substantial increase in grazing capacity through planned grazing systems designed to improve plant vigor.

Table 6.--Distribution of 1970 livestock grazing production and grazing under two alternative supply levels, year 2000, by major ecogroup

(million AUM's)

Ecogroup	1970	Alt. A[1/]	Alt. B[2/]
Western Rangeland	56.1	77.9	93.6
Western Forest	10.7	13.6	36.9
Great Plains Rangeland	92.8	96.1	119.2
Eastern Forest	53.5	132.1	316.3
Total	213.1	319.7	566.0

1/ Alt. A. represents the most efficient use of all range for grazing in attaining a national target of 319.7 million animal unit months of grazing under specified environmental and social constraints (See text section Supply and Cost). Intensity of management is tied to expected production of grazing and cost.

2/ Alt. B. illustrates where grazing would be produced under an alternative designed to produce 566.0 million AUM's of grazing at least cost when intensive management is applied to all areas. (Environmental values are protected against deterioration.)

In increasing range output to either the low or high demand estimates a lag of 3 to 15 years will precede attainment of full production. This lag is partly a function of the particular resource unit and its characteristics; but it also is a function of the capital available for installation of necessary facilities and practices and additional livestock.

In the Federal sector the lag may be due to appropriation levels. In the private sector, the availability of loans or other credit may affect the lag between investment and realization of full benefit.

The production indicated can be achieved whenever the decision is made to apply the necessary inputs, except for the lag of from 3 to 10 or 15 years required for the range to respond with the shortest lags, generally occurring in the more humid areas or on other favorable sites. Therefore, a production increase of 18 to 41 percent can be achieved and thus match the demand estimates of 1985, but the inputs must be applied soon if an 18 percent increase is desired. Even more inputs in a very short time must be applied to achieve the 41 percent increase.

Implications of Meeting Range Demand

Adding inputs to range and thereby developing that land to meet the low demand level represents a significant increase in emphasis on range as a portion of the total U. S. agricultural resource base. Range development at the low demand levels would permit the continued contribution of range to meet the historical trend in increases of food production.

The capacity exists to achieve a high supply of forage from range and to fulfill the high demand estimate. Increasing range development to meet the high demand level would enable the United States to use its range resource capability to help solve the problems of energy and to increase agricultural exports.

The production costs of range forage indicate that this source of production is "fully" competitive with other alternative sources. In addition, a lower share of these costs is from the use of fossil fuels.

Again, it must be emphasized that the competitive productive capability of range can be achieved without reductions in the total quality of wood growth or water yielded nationwide. Wood growth and water yield would be reduced in some ecosystems. Similarly, increases in sediment in stream channels or deterioration in the quality of water yielded from range land would not result from increased production of grazing.

The several social and rural area values of range grazing are also considered and protected in making production estimates. Many rural areas are currently dependent upon range grazing as a source of production and income. These areas and their people would be enhanced by additional range production. Increased or new grazing development in areas where the potential has been generally untapped will mean new productivity capacity and generate new wealth. Consideration and protection of the value of grazing to users of the public lands is also included in the supply estimates and costs. Many of the social values thus protected tend to increase costs because the relevant resource units kept in production may not be the most efficient in an economic context.

ASSESSMENT OF RANGE BENEFITS AND COSTS

Range practices, technology and improvements must be applied in the proper mix in order to achieve economically efficient and environmentally satisfactory results. The output of any one improvement of a set of improvements cannot be estimated with any high precision. It is the sum of all the practices--a system--that can be assessed. Therefore, individual estimates of the cost-effectiveness of individual practices or improvements are not convenient to compute, nor are they meaningful. Range management practices and range improvements can only be evaluated on a collective or package basis.

The analysis used in estimating the capacity of the range to meet demands is also the best estimate of the direct benefits to be achieved by development of the range. The most efficient lands for grazing are selected for added developments in order to insure that the cost of range development for grazing does not increase to the point that grazing becomes non-competitive with other feed sources. Development of productivity capacity that does not increase the per unit cost of the production, when that production is in response to National needs, represents a National benefit equal to the value of the added production. Development of the range as herein recommended meets that criterion and upon that basis such development is justified. The basic force in the analysis that applies specific costs and opportunities for production against the demand for that production is the most valid measurement of the validity of the development program.

Conventional "benefit-cost" ratios or cost-effectiveness analysis of the total range improvement and development program cannot be derived with the data available. Additional analysis of the livestock industry and of all livestock feeds would be necessary for such B/C computations. However, the following partial measures of benefits and costs indicate the massive benefits available from a properly coordinated USDA range program.

The benefits from the USDA range program are massive because:

1. The acreage involved is large relative to any other land use. (835 million acres was grazed on a range basis in 1970)

2. The utilization of range technology is low relative to any major segment of the agricultural industry.

The significance of range in agriculture has gone unrecognized because of the assumption that management alternatives and the subsequent production were extremely limited. Recent evaluations have shown that range:

--frequently is inefficiently developed

--has a productive capability at least 3 times higher than current production

--when properly managed, can be grazed by livestock in harmony with environmental needs, and

--is competitive with other forage sources at present and prospective supply levels.

A detailed and quantitative evaluation of the total USDA range development program needed to achieve an efficient increase in red meat production through the proper utilization of range requires assessment of all beneficial effects (benefits), and all adverse effects (costs). Many data elements of such information are not now available. Listed below are selected "benefits" and "costs" that should be considered:

Selected Range Benefits

Commodity & World Trade	Rural Development	Environmental
More beef and lamb	Increased rural income	Quality of water maintained
More wool and mohair	Increased rural economic activity and development	Stream sediment loads not increased
Increased agricultural exports		Wildlife and natural beauty not impaired
Improved balance of trade		Improved condition of NFS ranges
Lower relative use of fossil fuels and fertilizer		Improved condition of other ranges
Wood growth and water yield maintained		
Lower total cost for a given level of agricultural production		
Lower relative food costs		

Range Costs

Investments	Expenditures
USDA	
NFS range (direct land improvements)	Technical assistance
Education	Incentive payments
Demonstration	Cost sharing
State Agencies	
	Technical assistance
Private	
Land (land improvements)	Operating costs, interest
Livestock	Risk
Other livestock operation facilities	

Related to benefits from an increased national emphasis on range are other values, most of which have been presented in this report. The list follows:

--for each added AUM produced from the range resource the equivalent of 8 bushels of corn are released for export.

  --if AUM's produced are increased from 200 million per year to 400 million per year, then 1.6 billion bushels of corn equivalents are released for export each year.

  --1.6 billion bushels of corn at April 15, 1974, price of $2.41 per bushel is valued at $3,856 million.

--200 million additional AUMs will cost $684 million per year.

  --an additional 200 million AUMs at a gross value of $10.00 each would add $2 billion to the local producers' gross income.

  --local economies would have a total $4.7 billion in additional economic activity from an added $2 billion in local production.

  --an additional 200 million AUMs provide the feed equivalent to feed nearly 17 million more beef cows.

--added agriculture production through added range grazing reduces the total fossil fuel and fertilizer requirements for a given level and mix of U. S. production.

--development of added grazing in selected forested ecosystems on an integrated basis utilizes a resource potential now idle--and without reducing the timber growth.

THE USDA ROLE AND OPPORTUNITIES IN RANGE (NON-RESEARCH)

Scope of this discussion of the USDA Role and Opportunities in Range centers on authorities of the Assistant Secretary for Conservation, Research and Education related to"extension service," "forest service" (non-research), and "soil conservation activities" as made by the Secretary of Agriculture, (CFR Title 7, Subtitle A, Part 2).

The discussion is approached via the topical areas of education, technical assistance, demonstration, etc., rather than from the viewpoint of Agency authorities as delegated by the Assistant Secretary. Agency roles in range are described in Appendix F.

Complementing the discussion is information on economic intelligence--the statistical base and economic projection information (a responsibility of the Director of Agricultural Economics)--upon which the Department's range role strongly depends. Related activities such as incentive payments, regulation or credit, some of whose authorities for execution fall outside the authorities of the Assistant Secretary for Conservation, Research, and Education are discussed in the context of their need and relation to the areas of principal concern to this paper.

RESEARCH CONTRIBUTIONS AND NEEDS

Over the years, range research, helped by legislation which provided both the means for federal cooperation with State institutions on range research and which fostered the growth of a federal range research program, has solved many problems in range utilization, management and development. The scope of range research also has expanded from the west to include the south and southeast. It has been an assumption of this study that this technology is not fully being utilized. It is a further assumption that many opportunities for better understanding and more efficient use of the Nation's ranges have yet to be explored and developed. While it is not within the scope of the report (Phase I) to develop the research aspects of range use for meat production, it is within the report's scope and we believe, essential, to mention some of USDA's research efforts and list some areas of need.

USDA's agencies conduct comprehensive range research. They use every opportunity to transfer new research technology to user agencies and ranchers concerned with good range management practices. Annual reports and other publications convey the findings of research to users.

There are critical needs for additional research on management of range and livestock if goals are to be met. Specific needs exist for each ecosystem and managerial situation. Some examples are: biological control of pests, new legumes to reduce needs for energy and to improve quality and yield of forage, management of hydraulic and nutrient cycles for maintaining a safe environment, more economical guidelines for managing range, safer pesticides with improved selectivity, and a better understanding and data base for manipulating vegetative cover in terms of livestock production, wildlife habitat, water yield, and soil erosion.

These areas of research exemplify some of the opportunities. These and others will be discussed in Phase II of this report which is to be directed at research programs.

SCOPE OF USDA RESPONSIBILITIES (NON-RESEARCH)

The USDA has the major Federal agency responsibility for Range. As briefed in the role statements (Appendix F), Extension Service, Forest Service, and Soil Conservation Service collectively are directly or indirectly responsible for some aspect of management of all of the Range in the U.S.A. except the 207 million acres of Federal range outside the National Forest System. However, that Federal land also benefits from USDA range programs via Soil Conservation Service's soil survey and cooperative ranch planning activities. Thus, USDA has the key role in the degree to which more than three-fourths of the 835-million acres of range that was grazed in 1970 can contribute to the economic and social well-being of the Nation. USDA holds the Federal key to "more meat from ranges!"

USDA RANGE OPPORTUNITIES

This study has examined the prospects for range to contribute effectively in the long-run to meat production in the light of important issues. Study of its capabilities for increased production of livestock grazing in the press of more stringent environmental demands has been a major part of this examination. This review of America's Range situation suggests strongly the need to exercise a higher degree of concern for Range. The complementarity of Range <u>with</u> other sources of livestock feed energy--its true role,--<u>not</u> Range as a supplement to them, needs stressing.

Range has had a long history of use at less than effective levels. Its potential for contributing toward the Nation's goals of more meat at a reasonable price to the consumer and with profit to the rancher-producer has not been recognized. Range's potential has been overlooked.

Current world events--energy shortage, population increases with their accompanying expanding needs for food, increased demand for red meat associated with larger expendable incomes, and the need to improve the U. S. balance of trade--increase the total U. S. agricultural income and thus improve economic vitality in rural areas. All of these factors work together to suggest this is a time of great need--great opportunity--for USDA to move fully to exercise its responsibilities in range.

With its broad agricultural responsibilities, encompassing both direct relationships with the agricultural production community, as well as its public land administration responsibilities, the United States Department of Agriculture has many opportunities for increasing meat production from ranges. Most of these opportunities fall within the problem or need areas given below:

-education

-technical assistance

-demonstrations

-ranch planning

-public land management

-resource inventory and monitoring

-meat quality grading

-improved financing

-incentives

-economic and statistical intelligence

Coordinated efforts in these areas of responsibility can produce the response from both the public and private sectors necessary to achieve implementation of an efficient national range resource use program. Each opportunity area is discussed in turn in the following sections.

Education

Surpluses of the last four decades have caused us to take our agricultural abundance--and our production capabilities for granted. Red meat production is no exception. Thus, we have not been as innovative as we could have been in extending new technology in this area. It is common knowledge among those that are most familiar with the U. S. range resource, that many proven and economically sound technologies and business practices are not being used to their potential in the production of red meat from range.

The extendable information for increasing red meat production from range is concentrated in the files and minds of people who are unable to get it put into a highly extendable form that stimulates interest and application by producers.

If the technology developed by research is to contribute fully toward red meat production from ranges, it must be assembled and made available in ways that will instill interest in application by producers. A joint USDA-Land Grant University-Industry program to assemble range information in a highly extendable form would be a suitable starting point.

Such a joint program under USDA leadership would stimulate considerable increase in application of known range technology. This application could be further increased if those extending the information were trained in range and motivated to get range technology into application. The use of para-professionals could be effectively incorporated into extending information for increased red meat production from range if it were prepared in a highly extendable form.

The community resource development aspects for improving red meat production from range land are implied in this report. USDA could effectively utilize a highly extendable range program based upon existing range technology in educational programs for developing rural communities. No such program exists. Developing range livestock resources may be the most effective, community resource development tool available in many communities in rural America.

Technical Assistance

USDA agencies have provided technical assistance to decision-makers in planning, installing, and maintaining sound range management practices. This has resulted in significant progress in installation of range management. However, range scientists recognize that the potential still exists for major improvement in the range resource using present technology. Modification and intensification of our present methods of technical assistance can help materially to bring about this improvement. Emphasis is needed on planning and installing the total needed package of range practices and management to the land as a complete resource management system. By putting emphasis on the system, the interdependence of management and the needed conservation practices will receive more attention, leading to more effective range management directed toward conservation and production objectives.

Range management systems make maximum contribution to objectives and yield a full measure of benefits in relation to efforts if the conservation resources in the system are functioning properly. Measures must be carefully planned and installed. Equally critical to the long-term satisfactory operation of the system is maintenance of the improvements and prescribed management, yet maintenance is often the most neglected part of the three phases of work.

Intensification of technical assistance will increase the rate of range improvement. Frequent contact is needed to encourage the landuser to install his range management system . Acceleration of follow-up advice and assistance in installation and maintenance is needed. This can be accomplished provided additional trained personnel are placed on the job of direct range technical assistance.

Technical assistance in range has resulted in application of much sound range management on non-federal ranges. A strengthened program of technical assistance will require emphasis on all three phases of planning, installing,and maintenance of range resource systems. The opportunity is present for greater contributions to better use of non-federal range, and thus increased meat production via such an accelerated program of technical assistance.

Of major importance on non-federal ranges is the technical assistance, with or without cost-share incentive, provided by trained, experienced SCS field personnel working through soil conservation districts on non-federal ranges. Paraprofessional and professional range specialists, working in nearly every county within the private land sectors furnish direct assistance on a one-to-one basis to livestock farmers and ranchers to plan and install complete farm and ranch forage management programs. This method of assistance and motivation to range owners and operators can be accelerated to the desired level by increasing the cadre of range specialists accordingly.

Through its State and Private Forestry arm, the Forest Service has long provided technical assistance to State and private landowners on all forestry-related matters. More recently, through a tripartite agreement between the SCS, Extension Service, and the Forest Service, technical assistance can also be provided with respect to forest-range matters. Through close coordination and cooperation of the three USDA agencies with the State Forestry departments, State and private owners of forest lands can receive technical assistance in the use and management of all forest land resources.

Though the mechanism appears to be available, the forest-range assistance program is not as fully operational as it should be. Federal agency assignments and responsibilities in range matters need to be more closely defined and clarified, especially on State and private lands with non-commercial forest types. State agency commitment to sound grazing practices in the woodlands must be generated. Funds and personnel knowledgeable about proper livestock grazing in the forest types must be made available to the agencies so the landowner will be assured of sound technical assistance in accordance with his needs.

Demonstrations

This report identifies the problem that proven technology relative to increasing red meat production from range is not being effectively and efficiently utilized. Possibly no other teaching method holds the potential of correcting this situation than does a well-coordinated result demonstration program. People have more confidence in recommendations if they are shown that these recommendations are sound and based upon local results which are backed by research.

The importance of demonstrations should be considered in educational efforts to increase red meat production from range. The USDA administers public lands--the National Forest System--on which optimum range management could and should be demonstrated. Planning and management of such demonstrations should involve all concerned agencies and private cooperators with resources and demonstrable technology. Demonstrations should be given high priority in National Forest System range programs. As well as demonstrating optimum range management through the application of known technology, such demonstrations could also serve as testing grounds for new research that has reached pilot-scale testing level. They could also provide feedback to test the validity of generally accepted practices.

Demonstrations of range management systems on non-federal lands, accomplished primarily through land grant universities, state experiment stations, ARS and SCS special projects, offers one of the more effective means of accomplishing the goal of better range management. One of the most effective demonstration programs is provided by actual examples of successful management systems already operational on ranches. Sound examples are evident throughout the non-federal range sector. This method of demonstration was used successfully by soil conservation districts to promote widespread adoption of many conservation practices over the years. A concentrated effort to identify, document and publicize such actual examples will accelerate the acceptance and installation of proven range management systems.

Ranch Planning

More effective use of range resources depends largely upon the application of well-designed plans geared to meet the operator's goals but prepared in full consideration of regional and national needs. On-the-ground management of the land for high economic returns from livestock grazing is a primary goal for most operators as well as attainment of that goal in the short-run without jeopardizing the long-run capability of the ranch environment.

While much has been accomplished toward providing the basis for planning effective range livestock operations, intensification of these efforts is needed. In addition, the near-availability of prediction techniques augurs well for making ranch planning even more effective. These newer techniques need to be more fully put to use by the ranching community under sponsorship of the U. S. Department of Agriculture. Information concerning long-term projections of need for range grazing should be a part of an information system that is made available to the ranches via USDA programs in ranch planning.

Interdepartmental and intradepartmental agency cooperative agreements which provide for coordinated planning assistance by all affected agencies would do much to provide more effective planning with range producers. A coordinated approach would build regard for the resultant plans in the eyes of the range user and establish a coordinated base for future technical assistance.

Because of the interdependency of range with other resources and the interdependency of measures for conservation, development, and management of range, the systems approach should be stressed in range planning. A range management system, for example, would be the combination of conservation measures and management used by a landowner to reach his conservation objectives. This approach offers prospects for more effective planning because it helps the decisionmaker to recognize the interdependency of conservation measures and management and the value of planning and installing a complete plan for range improvement in order to bring about increased production.

Each ranch that undergoes such a planning procedure would use its biological resources at optimum efficiency. The ranch program would also benefit economically from a cash flow analysis. Such a systems approach, assisted by properly prepared computer programs, would allow for a substantial increase in red meat from the range resource by using it more effectively in an integral manner with other agricultural activities and food producing programs.

The systems approach requires that physiological functions of the livestock be identified by seasons or months of the year such as lactation or gestation or the breeding herd and growth and fattening of young weaned animals. In like manner, the amount of usable range forage, and crop hays or concentrates would be identified by months and physiological requirements of the animals. Adjustments to meet a balance of feed supplies with livestock requirements could be met in a number of ways on the basis of minimum costs.

Most ranches could increase the red meat produced per unit of land area substantially from a systems analysis approach that would lend credibility to the assisting agencies. Extension of this approach is recommended.

Public Land Management

A real opportunity exists for USDA to make a substantive contribution to the rural economy and environmental values through intensification of range programs on the National Forests and National Grasslands.

Livestock ranches of the West have developed a yearlong seasonal supply of forage by combining grazing on Federal lands with forage and feed from their privately owned lands. Many Federal grazing lands provide a suitable seasonal supply of forage that is not available through purchase or rental from private sources.

The Federal lands of the United States constitute a resource of national importance and are an integral part of the nation's natural resource base. Some 407 million acres or 21 percent of the conterminous 48 States are under Federal ownership. Of that area 373 million acres have a potential, at varying cost levels, for livestock grazing use.

Some 40,000 leases, licenses, or permits are issued to about 35,000 farmer and rancher families to graze approximately 5 million head of cattle and 7 million head of sheep on these lands. This represents about 8 percent of the total beef cattle and about 42 percent of the sheep in the United States. This amounts to about 17 percent of the total feed requirement for all sheep and beef cattle in the 11 Western States.

Values of Public Land Grazing

Forages of the Federal lands as with all range forages represent a renewable natural source of feed for the production of cattle and sheep. In this respect, the grazing of herbage from these lands, as on lands under State and private ownership, is a natural process in grassland, shrubland, and forest ecosystems that has occurred as long as grazing animals have existed. The value of and effects of grazing on the federally-owned range depends upon the kind of vegetation, the intensity of grazing, the kind of animal and the quality of management employed.

Of particular importance is the role of Federal lands in the economic and social stabilization of rural communities located in their midst. Grazing on public lands represents a gross product income of approximately $585 million annually to the United States and about $525 million annually to the 11 Western States. These figures represent a proportionate share of the animal unit months of grazing contributed from Federal grazing lands to the total gross income from the sale of meat (beef and sheep) and wool.

An increase in production capacities of Federal ranges and an increase in range livestock grazing would assist in easing the pressures on the needs for feed grains supplies at a time when the costs of these feeds have been increasing due to increased exports.

On the other hand, elimination of grazing from Federal range would require a shift of a considerable proportion of total range livestock numbers and their production to other lands and, in essence, would remove a sizeable proportion of this resource from the Nation's productive resource base. More animals on non-Federal lands would require more intensive use of private range, increases in pastures, harvested forages and feed grains, more acres in cultivation, and greater dependence on feedlot feeding for meat production. Although proportionately small in relation to non-Federal range livestock production, loss of Federal grazing would upset the supply-demand situation for beef cattle and materially affect the sheep industry.

National Forest System Grazing

The USDA is responsible for the administration and management of some 187-million acres of the Federal lands which comprise the National Forest System. More than 100-million acres of these lands in the National Forests and National Grasslands are open to grazing by livestock. Through this responsibility the USDA has an excellent opportunity to directly affect livestock forage supplies on one-eighth of the Nation's grazed range area.

Development of the ranges of the National Forest System to their economic potential for contributing more effectively to livestock production should be a USDA goal. The rancher would profit from higher income opportunities; the general public would profit from better resource management under range management systems that more nearly mesh with non-livestock grazing uses of the NFS range environment. If the rancher profits, and a majority of Forest Service permittees with cattle permits own less than 100 head of herd, the local community within which he resides and his trade area profits. Rural America benefits.

Available technology and skills should be put to work toward development and implementation of improved grazing management systems. Each system should be developed and managed in accordance with the productive potential and development and management costs. Systems should be designed to provide high quality forage for livestock while maintaining and enhancing environmental resources and outputs. Most of the ranchers and farmers grazing on the National Forest System depend on the seasonal grazing to make their operations viable year-round. Thus, any program designed to improve range resources on those public lands also directly benefits the dependent and interrelated ranch and farm lands. Even more far-reaching are the opportunities to demonstrate proper management in virtually all of the important forest-range ecosystems.

Through the direct effects upon the operations of grazing permittees and by demonstration of sound management (See Demonstrations), a USDA accelerated range program directed at more meat from ranges can affect a large segment of the rural, livestock economy throughout many areas of the U. S.

Full implementation of such a program and realization of its benefits will require many changes. Traditional negative attitudes about grazing woodlands must be overturned, resistance to change must be overcome, and funds and manpower made available to the agencies under long-term commitment to implement and demonstrate and operate sound management systems.

Resource Inventory and Monitoring

Although much information about the range resource is collected among the various agencies of the U. S. Department of Agriculture, there is high need for coordination of these efforts and development of a range resource inventory and monitoring system that can fully meet national needs for planning range program direction as well as for designing on-the-ground management systems. Consideration is needed for adjusting the bases for measuring range parameters so information collected by different sources will be fully meaningful when aggregated.

Public land management and technical assistance agencies need continuing information, through survey and monitoring, on the extent and condition of the Nation's range resources for program planning and for setting priorities. Industry needs range resource information for product planning. Citizens need it to understand an important part of their environment and recommend choices among conflicting demands.

Here is some of the needed information as currently assembled by USDA agencies:

Soil surveys being accomplished through the National Cooperative Soil Survey under Soil Conservation Service leadership, provide information about land resources that can serve as a basis for planning the improvement and maintenance of range management systems. Soils are correlated with management groupings such as range sites, vegetation types, forest suitability groups, and pasture groups. In planning efficient use of range resources, the location and extent of different kinds of soil and their behavior when used in different ways provide critically needed data.

The Conservation Needs Inventory (CNI) coordinated by the Soil Conservation Service provides information on range practices needed to achieve desired conservation and management levels on non-Federal lands. This survey provides national, state and county breakdowns of major land uses in acres. It lists the acreages needing treatment and major treatment practices.

The Forest-Range Environmental Study (FRES) assembled all of the Nation's range resource into a base of firm acreage, using information from other USDA sources--the CNI and forest survey type data. Technology developed in FRES enables planners at state and national levels to use the results of the inventories and studies to assess and summarize the forage potential of the various range types. They can determine the proper mix of management levels needed to

attain national forage production goals without impairment of the other resources and outputs from the land.

Detailed range ecosystem descriptions have been developed by the SCS for non-federal rangeland. These are commonly referred to as Technical Range Site Descriptions. They provide the basis to inventory and evaluate the present status of rangelands in relation to the ecological and productive potential. They provide a sound ecological guide to planning and installing rangeland improvement practices and bringing about subsequent red meat production. SCS has developed and uses similar data for grazable woodlands and native pasture in all non-federal forest areas. SCS also operates the Range Data System. The system collects by soil taxonomic units abundant data on climatic and physiographic conditions, compositions and production of plant communities in various condition classes.

More efficient measures of survey, productivity and planning need to be built upon those which exist. USDA Agencies, scientists and other Agency non-research professionals hold much knowledge of resource survey, monitoring and resource planning technology. This knowledge should be assembled, reviewed and proposals made for its efficient use or further development to benefit range and other resource areas.

Newer technologies of remote sensing need to be incorporated into operational resource information gathering and monitoring systems. Earth-orbiting spacecraft and high-altitude aircraft flights offer new and powerful tools for getting many types of data. Infrared and other special types of photography at high altitudes offer potentials for speeding up and improving soil surveys, ecosystem delineation and evaluation, and for monitoring other natural resources.

There must be free exchange and acceptance of data and technologies between Agencies and institutions at all levels. Agency policies must provide opportunities for using data and technology developed by others.

USDA Meat Quality Grading

Under current USDA meat quality grades, grass-fat beef from ranges is less favored in the marketplace than grain-fed beef. An opportunity exists to strengthen the demand for grass-fat or range-produced beef through adjustment of the quality grades.

Consumers evaluate beef visually when they select it at the meat counter and by taste when they are served. The literature offers ample evidence that visual preference is for the relatively lean beef commonly found in the lower USDA grades for carcass beef. For eating, consumers prefer beef that is tender, juicy and flavorful. Since consumers depend upon USDA quality grades to assure eating satisfaction, a high demand for U. S. Choice beef has been established. The meat trade has emphasized these grades in sales promotion programs. Because of this demand, a rather substantial price differential exists between U. S. Choice and lower grades of beef.

The majority of beef cattle feeders have established feeding regimes and management practices in an attempt to market U. S. Choice beef. Therefore, it is necessary that cattle be fed sufficiently high levels of nutrients to insure the deposition of at least a small amount of marbling (minimum for the U. S. Choice grade for young cattle) by the time the cattle are 18 months old (Jeremiah, et al., 1969). To obtain this marbling a layer of external fat is also produced on the carcass. However, consumers prefer beef with a minimum covering of external fat which is not completely compatible with their desires for higher quality grades. Therefore, retailers must now trim retail cuts to provide cuts with less fat covering than was the practice 15 years ago.

The meat industry nas become more cognizant of the economic loss that excess fat represents, and cattle feeders have adjusted practices in an attempt to produce leaner, higher valued carcasses. Breeds and strains of cattle have been introduced that are faster growing and later maturing and have a higher lean-fat ratio. However, it has been shown (Jeremiah, et al., 1969; Kauffman et al., 1968; and Ramsey et al., 1967) that faster growing, later maturing cattle require longer periods of time for fattening and for intramuscular fat deposition necessary to attain the level required for the U. S. Choice grade. Therefore, unless marbling is a consistent indicator of eating satisfaction in the subsequent meat product, it is probably economically unfeasible to feed for the subcutaneous fat levels necessary to attain the U. S. Choice grade (Jeremiah et al., 1969).

Since USDA quality grades are so widely utilized and since they markedly influence breeding and selection practices and dictate certain feeding and management practices, it is imperative that their structure and accuracy be carefully considered. Also, since marbling greatly influences the determination of quality grades, it is essential that its relationship to meat palatability and consumer acceptance be carefully and critically evaluated. Research has not been able to demonstrate that palatability and consumer acceptance are closely related with factors included in the USDA quality grade system (Jeremiah et al., 1970). However, the meat merchandizing industry relates palatability to grade and has been able to convince consumers to follow the slaughter grade standards as a guide to beef purchases. The USDA grades are vulnerable to this promotion program since the terms "Good," "Choice," "Prime" are value-laden.

Consumer studies have shown that the physical appearance of a meat product in the showcase (eye appeal) is the most important factor in the selection of meat products (Danner, 1959; Dunsing, 1959b; and Dunsing, 1959c); and that tenderness is the most important factor related to satisfaction during consumption (Rhodes et al., 1955 and Van Syckle and Brough, 1958). USDA grading standards provide the only basis for meat merchandising and, as such, assist untrained housewives in the selection of meat for palatability. However, a number of reports have indicated that consumers are satisfied with a beef product, regardless of grade, if it is tender, flavorful, lean and appealing to the eye (Dunsing, 1959a; Lane and Walters, 1958). Although Choice grade beef is not nutritionally superior or more palatable than Good grade beef, the whole system is biased in this direction. Thus, Good grade beef is discriminated against and consumers are forced to select within the Choice grade because of the specification buying of meat retailers which is geared to their promotion program and their desire to purchase a uniform product.

Moreover, most beef is bought and sold over the telephone where the description of value is implied in the grade quoted. While the companion yield-grade designation indicates the inherent cutability of carcass beef, the quality grade is still so broad that terms such as "High Good, Low Choice," etc., have been introduced by the trade in an attempt to improve the definitiveness of the quality grades. Unfortunately, the impressions of this adapted terminology varies with the individual. Marketing and pricing efficiency could be improved if more precise terms were used to designate quality.

Often packers will not buy finished cattle that do not have a good probability of grading U. S. Choice (fed grain for 120 to 150 days) because of the lack of demand for less than Choice beef by retailers. This results in less efficiency in beef production and the cost to consumers is increased because of the high cost of grain for cattle during the latter stages of a grain finishing program. Improvement in beef quality grade designation would change live

animal grades--probably resulting in more definitive terminology. This would facilitate movement towards the substitution of modern communication technology for current physical movements of cattle, buyers and sellers, while increasing market competition through increased buyer activity. Both marketing and pricing efficiency would be improved. USDA should, therefore, develop a beef grading system that identifies the characteristics more closely associated with the actual preferences of consumers. If this were accomplished there would likely be an increase in the production of red meat from range and other forages.

Improved Financing

The most critical problems in operator investment in range and livestock improvement practices are high interest rates and the lack of intermediate-type loans matching repayments to the schedule of returns expected. Increasingly, the inflationary trends in land prices limits many ranchers in making needed expansion to maintain an economical resource base. Commercial banks exhibit only limited interest in these kinds of investments, Production Credit Associations (PCA's) are production loan oriented, Federal Land Banks offer some opportunity for these kinds of loans, and Farmers Home Administration (FmHA) offers such loans to small operators in special situations. In the main, investment capital for range improvement is quite scarce, limited to the larger operators with considerable equity.

Achieving the higher productivity on individual ranches, which will result in more meat from ranges will require considerable investment in range improvements (fences, watering places for livestock, seeding, etc.), and in maintaining a higher livestock inventory. Management costs also will be higher. One of the reasons behind relatively poor financing for range operations is the long response time of range investments. Installation of a complete range improvement and management system may take several years and it may be several more years before the investment begins to produce at its planned levels. Grass seedings in semi-arid ranges may require two years of establishment before they can be grazed. In fact, installation of some systems may require a temporary reduction in stocking of livestock, thus a reduction in current income. But the critical factor is that all parts of the system have to be in place and fully producing before the potential for grazing can be realized and this can be ten years.

This lag time works against the operator in that currently he must repay his range improvement loan out of income that can increase only as rapidly as he can build his herd, and that, in turn, must await the coming on line of the added grazing from his improvement program. Current loan programs are not structured to provide flexible repayment rates according to slowly increasing returns.

If range improvements are to be applied on the scale necessary for meeting increasing demands for ranges to produce meat, it will be necessary for government participation through offering guarantees and lower interest rates on loans of a longer-term nature with built-in flexible repayment schedules.

Incentives

Improved incentives or cost-share programs will be an important aid in assuring installation of range management systems planned by the land user with technical assistance from USDA agencies. Long-term agreements should be favored over short-term agreements. In addition, there is a need to establish the cost-sharing or incentive aspects of improved grazing programs on forest lands.

Long term agreements whereby the livestock farmer and rancher develop a whole farm or ranch conservation plan and receive cost-sharing for installing the permanent type conservation practices included offer the most meaningful and enduring type of incentive. The conservation plan provides for the complete conservation program essential to provide for sustained use and protection of the soil, water, and plant resource base. This means that the vegetation management of grazing lands on a farm or ranch, for example, such as proper grazing use, deferred grazing and planned grazing systems are carried out without cost-sharing. The long term agreement is not consummated unless these non-cost share practices are accomplished along with the cost-shared practices such as range seeding, pasture planting, brush management, fencing, and water development.

There is a tendency to minimize the importance of ecological improvement of rangelands in some USDA cost-share programs. For example, the Rural Environmental Conservation Program (RECP) administered by ASCS requires that cost-sharing can be allowed only for erosion control and not for improvement in range condition per se. Yet other long-range USDA efforts are calling for increasing production of red meat. Improvement in range condition is one of the benchmark ways of increasing the productive capability of range. Cost-share programs which limit fencing for purposes of establishing planned grazing systems or which do not provide assistance for elimination of competition through tillage and establishing nurse crops to seed into, in poor condition ranges, do not recognize the importance of ecological improvement as a primary means of increasing red meat production.

Cost-sharing of vegetation management practices such as deferred grazing or planned grazing systems is usually not effective. While it often has numerous participants, the techniques of administering annual cost-share programs do not lend themselves to necessary

ecological manipulation of range. Too much rigidity in terms of setting deferment periods and in making them conform to program years is the biggest hindrance.

Examples of USDA cost-share programs, which with modification to recognize, as appropriate, the direct correlation of ecological improvement to the production of red meat, and which will provide for effective incentives are the long term agreements provided for through the Rural Environmental Conservation Program administered by ASCS and the Great Plains Conservation Program administered by the Soil Conservation Service.

Economic and Statistical Intelligence

Effective planning for livestock range programs in the years ahead will require reliable and readily available economics and resource information. Although useful range information has been collected, additional emphasis is needed upon obtaining the right kind of information in a timely manner.

Collection and synthesis of range supply and demand information into systems for predicting more effective ways for utilizing range would be a desirable assistance to setting national, regional, or State range policy.

Increased emphasis on improved collection, interpretation and dissemination of economic and statistical intelligence concerning the range-livestock-meat economy will be a continuing need. Improved data concerning seasonal range forage production, type and extent of range improvement practices, interrelationships of range grazing with other sources of feed and forage, range readiness, range condition, and forecasts of range feed conditions would facilitate periodic and rapid evaluations of range forage supplies at local, State and National levels.

Similarly, improved data concerning livestock numbers at the county levels and at higher aggregation levels, by class, weight, age, sex and source of feed and forage would, along with collected sales and price data, assist the industry in planning range use for meat production.

Of help to producers and policymakers would be periodic information about changing structure, size and tenure of livestock producing units, costs and returns, their contractual arrangements for buying and selling livestock, contractual arrangements for buying and selling livestock, contractual arrangements for leasing range, adequacy of credit, and land market activities and values.

The information collected in all these areas affecting range use and productivity in many instances needs to be prepared for incorporation into an analytical framework to provide information for determining policy and in carrying it out. Whether in raw form or presented in the framework of particular interpretations, these data would have immediate usefulness to livestock producers, range managers, and other segments of the range-livestock-meat economy.

Much of the foregoing activities has long been seated in Statistical Reporting Service, Extension Service, and to some extent, Economic Research Service, particularly the incorporation of data into an analytical framework. The main problem in this area is the lack of emphasis in the collecting of range and range livestock data. As demands for increased grazing from ranges occur, additional information targeted to the potentials for meeting this demand would be of considerable value to producers, agencies, and policy makers alike.

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APPENDIX

APPENDIX A

Appendix Table 1.--Range and forests of the United States excluding Alaska and Hawaii 1/

Land type	Acres (Millions)	Percent of Area, U.S.
Grasslands		
Plains grassland (shortgrass, midgrass, prairie)	211.7	11.1
Desert grassland	26.1	1.3
Pacific Bunchgrass	42.5	2.2
Mountain grassland (bunchgrass, meadow, alpine)	49.6	2.6
Annual grassland	6.7	.4
Wet grassland	4.5	.2
Subtotal	341.1	17.8
Shrubland		
Sagebrush	94.2	5.0
Southwestern shrubsteppe	38.6	2.0
Desert shrub	86.0	4.5
Mesquite Savanna	15.2	0.8
Chaparral (true chaparral, Mt. brush, Shinnery)	34.1	1.8
Subtotal	268.1	14.1
Western Forests		
Open forest		
Pinyon-juniper woodland	42.7	2.2
Ponderosa Pine	37.6	2.0
Fir-spruce	24.4	1.3
Lodgepole pine	19.1	1.0
Hardwood (Oak and Aspen)	23.4	1.2
Subtotal	147.2	7.7
Closed forest		
Douglas-fir	38.9	2.0
White Pine (mixed conifer)	4.1	0.2
Hemlock-Spruce	7.1	0.4
Larch	5.1	0.3
Redwood	0.9	(T)
Subtotal	56.1	3.0

Appendix Table 1.--Range and forests of the United States excluding Alaska and Hawaii 1/

Land type	Acres (Millions)	Percent of Area, U.S.
Eastern Forests		
North East:		
White-red-jack pine	12.6	0.7
Spruce-fir	23.6	1.2
Maple, beech, birch	35.6	1.9
Aspen-birch	22.6	1.2
Elm-ash-cottonwood	25.0	1.3
	119.4	6.3
Southeast		
Open forest		
Longleaf-slash pine	20.9	1.1
Loblolly-shortleaf	55.1	2.9
Oak-hickory	125.1	6.6
Oak-pine	34.5	1.8
Oak-gum-cypress	34.1	1.8
Subtotal	269.7	14.2
Total area in United States (48 States)	1,901.8	100.0
Range	1,026.1	54.0
Closed forest	175.5	9.2
Permanent pasture	101.1	5.3
Total range and pasture	1,127.2	59.3

1/ Grasslands, shrubland and open forests are classified as range. Data source: FRR, No. 19; some data regrouped to form land types shown here.

APPENDIX B:

LIVESTOCK GRAZING OPERATIONS AND RANGE USE BY MAJOR GEOGRAPHIC AREA

Livestock grazing operations vary area by area, ecosystem by ecosystem across the country. Climate, markets, operator goals--even tradition--all affect choice of operation. Most successful operations are patterned to fit within the common characteristics of the environment and market situation. General knowledge of these livestock grazing operations is essential to understanding range use. In the section that follows, the elements of livestock grazing operation in six major geographic areas are presented.

SOUTHWEST

Cattle grazing accounts for the large majority of livestock use in the Southwest. Sheep are locally important in a few parts of the region. Sheep operations occur in small proportion to cattle. Some isolated areas of goat ranching exist, particularly in the Southwestern shrubsteppe and Chaparral-Mountain shrub.

Most cattle operations consist of cow-calf and cow-calf-yearling. Calves are sold as stockers and feeders. In the desert areas, small base herds are more common, with steers bought during wet periods to use abundantly-produced annual grasses and forbs. Calving usually occurs year-round.

Desert ranges can be grazed yearlong. Grasses like black grama cure well and maintain some nutritive value yearlong. The desert grasslands are quite valuable for grazing despite aridity. Most of the grasses are highly preferred. During the growing season these grasses have a crude protein content of 8 or more percent, generally at or above minimum levels for livestock. Protein drops off to 4 to 5 percent in winter, requiring some supplementation usually with protein concentrates. Desert shrub areas have a more erratic type of forage production. Most of the forage is produced following rains (usually late winter and spring). It consists of annuals such as alfilaria, six weeks grama, and other annual forbs and grasses. Some shrubs, principally four wing saltbush provide nutritious, palatable feed. Four wing saltbush retains a protein content in excess of 11 percent yearlong.

The foothills type rangelands including pinyon-juniper and chaparral-mountain shrub ecosystems provide mainly spring-fall grazing for cow herds. The pinyon-juniper is an abundant ecosystem but relatively unproductive of forage. It has historically been heavily grazed because of its proximity to ranch headquarters and the better parts have been plowed for crop production. The chaparral-mountain shrub ecosystems generally provide limited grazing because the dense brush and tree cover make grazing difficult. Their primary use is spring-fall, or spring, summer and fall. Oak savanna areas of eastern Arizona and western New Mexico are productive of forage and are often used yearlong.

The mountains of the Southwest commonly support a forest cover of ponderosa pine, with occasional open, mountain grassland areas. Part of the precipitation here falls in the winter and spring from Pacific storms, and part during the summer from storms originating in the Gulf of Mexico. Grazing by cow herds occurs during the summer and fall.

Throughout the Southwest, brush has increased since domestic livestock grazing began several hundred years ago. Palatable, perennial grasses have decreased, and in some areas like the Desert Shrub they have been largely replaced by annual grasses and forbs.

PACIFIC WEST

Most of the cattle grazing operations in the Pacific Northwest are commercial brood-cow and calf operations, and the grazing is largely on lands where forage improvements, if any, include little or no irrigation. At least three-fourths of the brood-cow yearly diet is from on-site grazed forage. Cow herds are fed hay in the winter period.

Most Pacific Northwest calves are shipped out of State as feeders. Only about 11 percent of the beef cattle inventory is kept within those States for feeding, despite the fact that these States consume more beef than they produce. Feedlots currently operate largely on feed grains and in the Northwest, where the main grain production is wheat, the feed-type cereals are mostly imported.

Northern California, with its mixture of valley lands and timbered mountain ranges, has the typical cow-calf operation of the Pacific Northwest States. However, in the California annual grass type, and in the shrub areas of southern California, there is no one predominant type of cattle operation. Type varies from cow-calf, to yearling, to feeder operations. In general, California cattle obtain 60 percent of their yearly diet from on-site or grazed forages and roughages. About 65 percent of the total beef cattle inventory of California is in cow-calf operations, and 35 percent is in stockers or feeders. The status of feedlots is presently rather static due to adverse pressure of environmental groups and only beginning demands for feedlot residues such as fertilizer.

Range sheep production in the Pacific Northwest was once competitive with range cattle. However, today, range bands are greatly reduced in numbers, and there are more sheep bands in valley situations under woven wire fence than there are on so-called open range with herders in attendance. Sheep in California are on foothill and mountain-lands of the Coast Range and on foothills of the west side of the San Joaquin Valley.

The mountain grassland ecosystem, which lies between the valley and timbered mountains typically is grazed for two months in the spring and two months in the fall by cow-calf operations.

Productivity of the mountain bunchgrass is high, yet nutritional value often drops below adequate levels in the late summer and fall or the forage dries. During about one-third of the fall period, seasonal rains when followed by ten days of adequate growing temperatures, permit fall regrowth which has good protein content.

Subalpine grasslands, occurring in limited acreages at higher elevations are used as summer sheep range. Mountain meadows, some of the most productive native grazing lands, occur as small tracts interspersed with timber or as parts of huge mountain valleys. They are grazed in the summer, or in both summer and fall if the elevation permits.

The California annual grassland ecosystem, prominent in much of California foothills, is used during fall, winter, and spring periods. It is a very good source of forage in connection with yearling or feeder operations. Coupled with the use of the annual grasslands and rations for feeders or stockers are improved pastures and grazing of aftermath of various crops. Some cow-calf operators make use of the annual grass type until it dires, then move their herds to higher elevation timber types or to renovated or suitable mountain shrub areas for summer grazing.

Chaparral-Mountain Shrub occupies mountain areas over 3,000 feet elevation, yet grows to sea level in some situations. The shrub species vary from deciduous, to semi-deciduous, to evergreen. Some of the brush types are so dense that understory vegetation is almost absent. In other cases, the shrub overstory permits a highly productive understory. Shrub control efforts and grass reseeding have provided good forage in some the shrub zone. Thus, summer livestock grazing is the principal enterprise in areas where mixture of forage types, natural low density of shrubs, or shrub control exists.

Ranchers living within a reasonable distance of mountain-timbered summer range often combine grazing of sagebrush range with mountain summer grazing to achieve forage supplies for all but the winter feed period. Ranch operations in the heart of the sagebrush country try to make this range serve their needs for spring, summer, and fall. Ideally, however, sagebrush range should be used as spring-fall range. Many operators "make do" by also providing small tracts of irrigated meadows interspersed with sagebrush, or by supplying supplements.

Throughout the Pacific West, forest ecosystems provide considerable livestock grazing on a range basis. The most valuable forest ecosystem for range grazing is ponderosa pine. In prime condition, ponderosa pine is open forest, with an abundance of forage. The ecosystem has green feed of good protein content during the hot-season period. This characteristic gives the ponderosa pine type a premium or extra incremental value over lower elevation range.

Ponderosa pine forest is used mainly by cow-calf operations as summer range. A small proportion of operators judge its forage value adequate for yearlings. Some range-sheep bands also use the type in the summer. Impacts on the type which have contributed to a serious situation are improper grazing practices before the turn of the century and suppression of fire after 1905. These two actions have, after almost 70 years, resulted in many stands of ponderosa pine being overcrowded with growth-retarded small trees.

Coastal Douglas-fir and interior mixed conifer ecosystems occupy western Oregon, western Washington, and the northerly slopes of all interior mountains. The productivity of the forest floor is poor (0 to 50 pounds of air-dry herbage per acre) prior to logging, but may increase greatly following logging. The openness of a particular logging or harvest system regulates the amount of usable ground cover produced. Because these tree species are so shade-tolerant, they tend to naturally provide a closed canopy in about 20 years. After tree seedlings are re-established, the forage produced during this 20-year period is often abundant, but the nutritive quality is variable and uncertain. With better utilization of forest residues, treatment of slash, and reseeding of improved ground cover, possibilities exist for summer-season herbage production of 1,200 to 1,800 pounds or higher per acre. Limited summer use by cattle is being tried on a tentative basis.

INTERMOUNTAIN

Most of the range forage in the Intermountain area is used for cow-calf or ewe-lamb operations. Nearly all of the lambs are sold as feeder lambs and it is estimated that 80 percent of the weaner calves not held for replacement are sold as weaner calves to be moved to feedlot areas during the winter and spring. The remaining 20 percent of the weaner calf crop in the Intermountain area is dept by the operator and sold as yearlings. This presents a form of flexibility in operations to cope with variability in forage production resulting from intermittent drought years and above average moisture years.

The arid range area of the Intermountain area is ideally suited to feeder calf and lamb production since there is only a small amount of concentrates raised in these arid areas and these are more profitably fed to dairy herds.

Livestock operators of the Intermountain region which consists of Idaho, Nevada, Utah, western Colorado and Wyoming, make use of seasonally-productive range lands by moving animals from one geographical range to another. The desert ranges are used during the winter (November 1 to April 5) and the foothill or intermediate elevation ranges are used during the spring (April 5 to July 1) and some are used in the fall (October 1 to November 1). The mountain ranges are

used during the summer (July 1 until about September 15). Sheep are frequently trucked or driven hundreds of miles to and from these seasonal ranges.

Of great importance is the comparative nutrient value of different forage plants during the various seasons and the ability or inability of these forage species to meet the requirements for optimum livestock production. Animals in the Intermountain area do not need a supplement during the spring and summer range grazing seasons if the plants are growing. During the fall and winter, supplements often are necessary because the forage nutrient content is marginal for animal needs and inclement weather may seriously reduce daily intake.

Spring Range

A scarcity of suitable spring range in the Intermountain area generally is a limiting factor for successful livestock production. During recent years, it has become common practice to seed depleted foothill range to provide more suitable forage for spring grazing.

Grass species such as intermediate wheatgrass or Russian wildrye often are planted to help provide needed nutrients when native foothill ranges are mature and deficient in nutrients. An alternative, when foothill ranges become dry and dormant, is to move animals to higher elevations where feed is still green and growing. This is sometimes difficult because it puts an additional grazing load on ranges that must also be grazed in the summer.

Summer Range

After animals leave the Spring ranges (about July 1) and move to high-elevation summer ranges, they are on vegetation that is less mature. Nutrient levels in the plants are higher and deficiencies are rare during early summer. However, if the grazing animals are confined to a few species of any one forage class (grasses, forbs, and browse), or to only one vegetation type, deficiencies may develop as the plants mature. On most Intermountain ranges deficiencies are not the case because the diet may be composed of as many as 100 separate species which represent several vegetation types and all three forage classes.

Winter Range

The vegetation of desert ranges of the Intermountain-Great Basin region is composed primarily of browse species with various quantities of grass. Generally, desert browse plants meet the protein requirements for livestock during gestation and are exceptionally high in carotene. However, they may be slightly deficient in phosphorus and

decidedly low in energy furnishing constituents. Grasses, during the winter, are markedly deficient in protein, phosphorus, and carotene but are good energy sources. Forbs are generally sparse on desert ranges and are unimportant in the diet during winter grazing. If the diet is largely grass, phosphorus and digestible protein may be markedly deficient but, if the diet is largely browse, energy may be decidedly deficient.

Animals on many winter ranges may require a particular supplement to meet the requirements when properly grazed but with increased grazing intensity the quantity and even the type of supplement needed may change. Overgrazing may result in a need for a greater quantity or even a more expensive supplement over a longer period of time.

GREAT PLAINS

The Great Plains occupies approximately one-third of the United States and includes parts of ten States (Montana, North Dakota, South Dakota, Wyoming, Nebraska, Kansas, Colorado, Oklahoma, Texas, and New Mexico). This vast area of semi-arid, high-plateaued grasslands, once known as the Great American Desert, varies in topography from extremely flat to quite rolling. In general, it is covered with short grasses and mid grasses, but in the Black Hills of South Dakota, it is covered with trees. On the eastern edge and scattered throughout on deep, sandy soils are large areas of the highly productive tall grass prairie.

Soils in the Great Plains range from very deep, black soil, high in organic matter in the more humid areas to very thin--almost colorless soils that are low in organic matter in the drier regions. Generally, the Great Plains are characterized by extremely cold winters--especially in the North--and warm summers with relatively low precipitation and humidity. Wind is common and often accompanied by sudden variations in temperature. Precipitation varies from 15 to 25 inches annually in the southern portion to 12 to 15 inches in the Northern Great Plains. It is higher in the eastern edges of the Great Plains, and for example, may exceed 30 inches in eastern Kansas and Oklahoma. Growing seasons range from 110 to 120 days in the Northern Great Plains to over 240 days in Texas and New Mexico.

Indians, the first inhabitants of the Great Plains area exploited the native buffalo for their own use. Around 1870, when cattle had replaced the buffalo, livestock ranching became the dominant way of life. Grain farming increased in the 1880's and 1890's during years of adequate rainfall. When drought followed, many farmers left; those that remained usually added some livestock to their operation. As of January 1, 1970, there were estimated to be in excess of 14 million beef cows in the Great Plains States. These were fairly evenly distributed throughout the Great Plains from north to south.

Most of the range in the Great Plains is in private ownership. There are some scattered parcels of Federal land, some land under ownership of the States, counties, and some lands under ownership of the railroad companies.

Northern Great Plains

The Northern Great Plains covers an estimated 300,000 square miles--which is approximately one-tenth of the total land area of the United States. The range in the Northern Great Plains occurs in the western three-fourths of North Dakota, South Dakota, and Nebraska, and the eastern two-thirds of Montana and the eastern one-half and the eastern one-fourth, respectively, of Wyoming and Colorado. Perhaps only one-fourth of the Northern Great Plains area is under cultivation. Production of both cultivated crops and range forage varies greatly from year to year and from one area to another within the Northern Great Plains. Droughts are frequent and records indicate that precipitation in certain parts of this area has dropped below 75 percent of the normal on the average of once in every five to eight years. Native range can best withstand these successive drought periods.

While cultivated crops may be of importance, especially in local areas, grasslands are the principal resource base for the agricultural economy prevalent in the Northern Great Plains.

Livestock in the Northern Great Plains graze the native range species for about 8 to 9 months of the year from April to December. During the cold and stormy winter months, livestock are generally fed in holding pastures near farmsteads or on range areas where shelter is provided by breaks in the terrain or creek bottoms where trees are generally present. Many range areas in the Northern Great Plains furnish perhaps one-half of the nutrients needed by livestock. An additional 30 percent comes from grassland hay, which is useful during the longer winter periods in the North. The rest of the annual feed requirements comes from supplemental feeds and cultivated cropland.

Some livestock operations in the Northern Great Plains are a straight cow-calf enterprise or a steer operation, but in most cases the livestock operator runs an all-age group where he sells weaner calves, yearlings, or even two-year old steers.

Sheep operations are still common, but are perhaps less than 30 percent of their numbers thirty years ago. Sheep ranches are prevalent in rough country where browse is available for winter feed. In many cases where topography is highly variable and vegetation composition is complex, both cattle and sheep are managed to more fully utilize the range forage resource.

The major range types in the northern Great Plains consist of the short-grass and mixed grass prairies. The sand hills are also important vegetation types and occur mainly in west-central Nebraska with smaller areas in adjacent states. Precipitation varies from 15 to as high as 20 to 22 inches annually. Since moisture is rapidly absorbed into the soil, there is little runoff; therefore, the effective precipitation is greater in the sand areas.

The sagebrush-saltbush grassland that occurs in the Northern Great Plains is called the Red Desert and covers some 43,000 square miles. It is generally the most arid part of the Northern Great Plains with a precipitation ranging from 7 to 12 inches annually and soils are often alkaline or saline. This area is grazed mainly by sheep in the fall, and winter when snow is available.

In the Black Hills of South Dakota and the Bighorn Mountains of Wyoming and other local areas, grasses an open forest type that includes ponderosa pine, Douglas-fir, and some spruce at the higher elevations. This may cover almost 20,000 square miles in the Northern Great Plains and produces considerable amounts of usable forage that is used primarily by cattle during the summer.

Southern Great Plains

The Southern Great Plains is a leading cattle-producing and livestock farming area that includes over 130 million acres of southeastern Colorado, western Kansas, and western Oklahoma and Texas, and parts of northeastern New Mexico. Like the plains area to the north, the climate of the Southern Great Plains is extremely variable from year to year. Rainfall is generally limited, humidity is low, and high winds cause high evaporation rates.

Year-long grazing of range is the common practice in the Southern Great Plains, especially with breeding herds. Cultivated crops are often used to supplement winter range and wheat pasture is an improtant winter and early spring forage. In the extreme northern part of this area, ranges may be used from April or May to October or November as is the case farther north in the Northern Great Plains.

The vegetation and topography is excellent for cattle. However, the environment is generally more suitable for production of young animals. Calves are sold primarily as stockers and feeders.

Fattening of these animals in nearby cropland areas has increased significantly in recent years. Some supplemental feeding is practiced in winter for increasing protein. The use of crop residues in parts of the Southern Great Plains and wheat pasture in fall and spring is common. Sorghum pastures for late summer grazing is rapidly increasing throughout most of the Southern Great Plains.

The tall grass prairie in the eastern portion is among the world's most productive grassland areas. The vegetation is comprised primarily of tall grasses, some of which exceed six feet in height. Precipitation ranges from 25-38 inches annually, most of which occurs during the summer growing season. The forage of this area can support many cattle. Compared to more xeric, or drier, areas, the vegetation does not cure well. Protein supplement is needed throughout the winter months. Areas which once largely grazed steers in the spring and summer are now being converted to cow-calf operations.

The principal range forage types in the western portion of the Southern Great Plains consist of short and mid grass vegetation that occurs on the heavier textured soils. On the more sandy soils along the streams in this area, a mid-grass and a tall-grass vegetation type occurs. The shortgrass vegetation type is dominated by blue grama and buffalograss.

THE SOUTH AND SOUTHEAST

Grazing use of eastern USA forests and other native grazing lands by domesticated livestock extends back more than 400 years. Cattle and horses introduced by Spanish explorers in the 1500's were the antecedents of the millions of livestock that now obtain forage from these lands.

Until the 1940's, beef cattle and sheep production was incidental to the principal uses of cleared eastern forest land for raising of cotton and tobacco. At the same time, livestock were allowed to run free in the woods and forests. However, the relatively infertile, cleared forest soils were depleted by constant cropping, and cash returns dropped, especially during the depression of the 1930's. Ways were sought for rehabilitating seriously-eroded cotton and tobacco lands and providing alternative sources of cash income. Many eroded croplands were planted to trees. But farmers still needed current cash income while awaiting the 15 to 20 years necessary for the planted tree crops to reach pulpwood size.

Interest increased in beef cattle raising as the needed income source. This interest quickened when it became known that many southern and eastern forest soils could produce high yields of forage when soil fertility needs were met. In addition, high yielding species or strains of grasses and legumes were developed, among them the pioneer Coastal Bermuda grass.

The major shift in emphasis from cotton and tobacco to trees and cattle resulted in changing patterns of land use from Virginia, through the mid-South and deep-South States to the piney woods of East Texas.

Cattle, sheep, and hogs were still allowed to graze and forage in the woods, but interest heightened in raising beef on improved pastures. With this heightened interest came major increases in beef cattle numbers in the South. Beef cows increased in the 12 southeastern States (Florida, Mississippi, Louisiana, Alabama, Georgia, Arkansas, Kentucky, Tennessee, North Carolina, South Carolina, Virginia, and West Virginia) from 2.8 million in 1950 to 9.2 million in 1970 (Van Arsdall and Skold, 1973). Availability of technology for more effective cattle grazing of southern pine forests accompanied these increases.

Animal Production

The great diversity of southern land types and agricultural patterns has resulted in a broad mix of livestock operations situations. Many highly developed and intensively managed improved pasture situations exist upon which are raised purebred or commercial beef herds. Other operations include "hill" pastures--generally Kentucky bluegrass pastures with mixtures of other grass and legume species--augmented by bottomland pastures grazed seasonally.

In some areas of the South, cattle may graze entirely upon farm woodlands and pastures. However, many depend largely upon industrial forest lands and National Forests. It is not unusual for cattle to graze yearlong in the forest with no provision for rotation, except for that associated with range burning.

Systems for grazing pine forest ecosystems have been developed that are compatible with tree growing. Cattle also graze hardwood forests, where generally it is often highly damaging to tree growth. Few sheep now graze the forests, and foraging by hogs is discouraged because of their tree-destroying potential.

Production of feeder calves is the principal goal of many operators. Some calves are held on the larger ranches and sold as feeder steers.

Beef Cattle Herd Sizes

Beef cattle herd sizes vary greatly across the South, with the largest (often more than 500 brood cows per herd) in South Florida, the Blackbelt of Alabama and Mississippi, the Mississippi Valley upland and adjoining Coastal Plains of Alabama, Mississippi, Georgia, and Louisiana, and the Mississippi Delta (Crom, 1974). Elsewhere in the South, herds generally are small, with as many as 80 percent of the herds comprising less than 20 brood cows. Owners of these small herds of beef cattle also have low incomes.

Production Efficiency

Production efficiency is low on the usual range operation. Animal husbandry practices often include yearlong breeding using low quality bulls. Calf crops of 50 percent to 60 percent are common. Weaning weights of 300 pounds are common although these can be increased to more than 400 pounds at 8 months with application of existing technology. Calf crops also can be increased. In some cases calf crops of 80 percent or more have been consistently obtained from herds that use forest grazing as part of their yearlong forage and feed regime.

Protein content of the vegetation often is seasonally below minimum requirements, especially for lactating females, and animals must be fed protein concentrate or provided other forages of adequate protein content. Prescribed burning of southern pine forest types has long been used to upgrade the protein quality of the vegetation.

The young growth of grasses, weeds and other plants that grow back after the fire is highly nutritious for a short period and cattle make good weight gains while grazing it. Where combined with complementary sources of livestock feed and forage, suitable yearlong livestock production system can result.

Long growing seasons--to as much as 10 or 11 months in South Florida--reduce the need for extended feeding, although subfreezing temperatures affect forage quality and can require winter feeding. In the southern portions of the South, winter rations often consist of a combination of pasture and crop residue. Further north, hay and some feeding of concentrates are provided.

APPENDIX C

APPENDIX TABLE 2. Assumptions of Low Demand Estimate

Item	Unit	1970	1980	1985	2000
Population	Mil.	205	224	236	264
Beef consumption per capita	Pounds	114.7	130.0	131.2	135.0
Lamb and Mutton consumption per capita	Pounds	3.5	2.2	1.8	1.8
Live weight per pound carcass	Pounds	1.75	1.75	1.75	1.75
Share of production in feedlots	Percent	25	36	36	36
Requirements for herd expansion	Percent	---	3.75	---	3.50
Improved feeding efficiency	Percent	---	1.2	2.4	7.0
Feed grain oriented rations		yes	yes	yes	yes

APPENDIX D

APPENDIX TABLE 3. Assumptions of High Demand Estimate

Item	Unit	1970	1980	1985	2000
Population	Million	205	224	236	264
Beef consumption per capita	Pounds	114.7	133.7	143.8	155
Lamb and Mutton consumption per capita	Pounds	3.5	2.8	2.7	2.5
Live weight per pound carcass	Pounds	1.75	1.75	1.75	1.75
Share of production in feedlots	Percent	25	25	25	25
Requirements for herd expansion	Percent	---	3.75	---	3.75
Improved feeding efficiency	Percent	---	1.2	2.4	7.0
Feed grain oriented rations		Yes	No	No	No

APPENDIX E:

APPROACH USED IN ESTIMATING EFFICIENT SUPPLY ALTERNATIVES

All of the forest and rangeland areas--1.2 billion acres-- in the first 48 States are included. This entire area is subdivided into 956 resource units, each of which has common characteristics of ecosystem (one of 34), owner (one of 3), productivity (one of 4 classes), and range conditions (rangeland), or timber stand size class (forest) -- (one of 3 classes in both instances).[1/] For each resource unit the appropriate quantities of management, facilities and range practices, and their costs were assembled as packages that, when applied individually to that resource unit, would meet the production and environmental goals of each of five levels or strategies of range management.

An infinite number of strategies could be developed but the five management strategies devised represent the scope of available options that are a cost effective means of maintaining or increasing forage production.

The five strategies are defined as follows:

Environmental management without livestock,

> Livestock are excluded and no cost is charged to grazing. Costs of environmental protection are charged to the activities benefitting from using the resource.

Environmental management with livestock.

> Livestock use is within the apparent existing capacity of the range environment and within limitations of multiple use. Livestock control is attained but no attempt is made to achieve livestock distribution.

Extensive management of environment and livestock.

> Management systems including fencing and water developments are applied as needed to obtain uniform livestock distribution and uniform plant use while maintaining plant vigor within constraint of multiple use.

Intensive management of environment and livestock.

> All available technology for range and livestock management is considered in order to maximize livestock forage production consistent with multiple use and maintenance of the environment. Existing vegetation may be replaced through improvement of growing conditions.

1/ Only 956 out of a possible 1,224 resource units are valid units.

Environmental management with livestock production maximized.

The emphasis is on livestock production without multiple use requirements, but stewardship of soil and water is required.

Environmental impacts and outputs are estimated for each of the management strategies in each resource unit.

Estimates of which management strategy is most appropriately applied to each resource unit has been determined through the use of a mathematical model (Kaiser, et al, 1972). The subsequent assignment of management strategies conforms to a criterion of the least cost production of a required quantity of grazing within specific limits. These limits are designed to reflect the historical perspective of range use, environmental values, social and political institutions.

The productivity of the range, therefore, is based on the premise that both physical and economic efficiency, both economic and non-economic values, must be considered in assessment of range production opportunities. To measure the "real" potential, each different resource unit is assigned the level of management and development, at a cost, that can be reasonably expected to result in the total highest environmental, social, and economic benefit.

The quantity of materials, labor, and management are identified as to frequency of occurrence or length of life. The costs are then computed as average annual costs per acre. Interest at six percent was added to reflect true costs of investment and to balance the selection of management strategies on resource units requiring different levels of capital investment relative to annual operating costs.

The costs are the total annual costs of investments in land. Cost of livestock and direct livestock management, or other costs of livestock operations not directly used on the land and its management are not included.

Geographic distribution of forage production and related livestock is, therefore, based on the cost of producing forage. Other significant economic and institutional factors are handled as limits or constraints on the model.

APPENDIX F:

NON-RESEARCH ROLES OF SELECTED AGENCIES OF THE U. S. DEPARTMENT OF AGRICULTURE AS RELATED TO RANGE

COOPERATIVE STATE RESEARCH SERVICE

The role of the Cooperative State Research Service is to administer Federal funds appropriated by the Congress (Hatch Act, McIntire-Stennis, Special Grants, and Rural Development Act of 1972) to the Land Grant Universities and other cooperating institutions for the purposes of conducting appropriate research. The agency also maintains a current research information system (CRIS) for all research units of USDA and research projects of cooperating institutions receiving USDA funds and maintains a research referral office for effective review and coordination of all USDA-supported research work units.

A portion of these funds is utilized for research on range, rangelands and red meat production on rangelands. While the primary function is research, there is close association between the research agencies, action agencies, and ranchers and livestock producers. Researchers provide needed information in desirable forms for use by action agencies and producers. In turn, the producers and action agencies identify critical problems requiring research. The close liason is enhanced by the fact that many individuals in the cooperating institutions have joint research-extension responsibilities.

ECONOMIC RESEARCH SERVICE

Appropriations to the Economic Research Service are for purposes of supporting research on the economics of food and fiber production, marketing, and distribution, the economics of the use and management of natural resources, the economics of rural economic development, foreign trade, and foreign development assistance. The Economic Research Service also provides a non-research role for the Department and the agricultural establishment. In fulfilling its objectives of providing economic intelligence to public and private decision makers in Federal, regional, State, and local agencies, it generates information and expertise useful for non-research activities. Through conducting programs of economic research, professionals in ERS develop information and experience useful for assisting in programs of extension education, technical assistance in farm or resource management and planning, or on the efficiency of the marketing and distribution system.

Additionally, the ERS compiles, develops, and publishes statistical and economic data relating to the current outlook and situation for commodities and input markets. These data serve a dual role to support research analyses as well as being useful for non-research functions such as education, technical assistance, and direct use by farmers, ranchers, and agribusinessmen.

The ERS is frequently called upon to be of technical economic assistance to other agencies in the Department--agencies which have non-research missions. These requests vary between relatively continuing analyses of river basin development for the Soil Conservation Service or researching and advising upon foreign economic developments for the Agency for International Development, Department of State, Memoranda of Understanding for cooperative programs as with the Extension Service, and special studies for the Agriculutral Stabilization and Conservation Service, Foreign Agricultural Service, Agricultural Marketing Service, Animal and Plant Health Inspection Service, Farmer Cooperative Service, Packers and Stockyards Administration, and the Forest Service. The Economic Research Service also works closely with the Statistical Reporting Service, the data-gathering arm of the Department.

Input of the Economic Research Service into the programs of educational, resource monitoring, management, and planning, policy administration, and assistance to action agencies stems from its research programs and expertise. In efforts to provide economic intelligence of practical value to decision makers, its products and personnel are of direct use to the programs of other agencies.

USDA's Economic Research Service has an ongoing program of research that deals directly with the domestic livestock-meat economy and land resource base. At the same time, international trade activities, particularly for the basic commodities, are subjects of analyses.

The Commodity Economics Division, through its Meat Animals Program Area, recognizes the need to define consumer demand for meat to ascertain the most efficient and equitable production, processing and distribution system and indicate changes needed in industry organization to move toward more efficient production-marketing systems. An integral part of the meat production process is the use of range in the production of beef cattle, sheep, and goats.

Research results are used by consumers, farmers and ranchers, farm and ranch suppliers, meat packers and processors, food retailers, marketing agencies, public policymakers and private consultants. Of particular importance is the need to provide economic intelligence to the Department and its agencies, and the Congress on matters pertaining to agriculture, and more specifically, the livestock-meat economy. In this respect, the Meat Animals Program Area must be prepared to incorporate the body of data obtained in its research into an analytical framework to provide information concerning the probable consequences of pending policy or other decisions.

Cooperation is maintained with other program areas within ERS concerned with input production (feed grains and non-farm inputs), environmental quality, pricing and aggregate measures of economic performance. Joint research and exchanges of information occur with economists and biological scientists at the State Agricultural Experiment Stations.

Specific research projects underway by members of the Meat Animals Program Area include: Structural characteristics of the beef and pork subsectors; aggregate analysis of meat animals industry performance; economic impact of environmental regulations of the livestock-meat industry; economics of alternative technologies and management systems in livestock production; domestic and foreign demand for red meat and by-products; and outlook and situation long-run projections (meat animals).

Enterprise budgets, costs and returns, input-output coefficients, the number of firms involved in an enterprise and their collective market share are the basic economic data which are being developed in all producing regions to describe and evaluate the structural characteristics of the beef, pork, sheep and goat subsectors. Forest-range ecosystems are an integral source of the forage input in the cattle, sheep, and goat raising enterprise budgets. An estimated 10.25 SMY's of professional time was allocated to this project in FY 1974; another 7.75 SMY's were assigned for support. In addition, about $70,000 of cooperative research with universities was conducted in FY 1974.

The Natural Resources Economics Division of ERS has concerned itself with forest-rangelands to the extent of maintaining an overall national inventory and assessing future requirements. Forest-range use by livestock is accounted for in the course of determining the use of resources in the OBERS projections of regional economic activity in the United States.

EXTENSION SERVICE

The Extension Service is the educational agency of the U. S. Department of Agriculture and serves as the national office for the U. S. Cooperative Extension Service system. This national system includes a Cooperative Extension Service by that name, or "Agricultural Extension Service," at each of 52 Land Grant Universities, and staff in most of the counties in the United States. The name "Cooperative Extension" derives from financial and administrative arrangements involving three levels of government--Federal, State and County.

Through this unique network of Federal-State-County relationships, the Extension Service conducts educational programs of significance in achieving local, State, and national goals. Within this nationwide system, research results of the Land Grant Universities, agricultural experiment stations, and USDA research agencies are directed toward solving problems of the American people.

The Extension Service system uses the skills of about 16,000 professional workers, 10,000 support staff, 11,000 program aides, and more than one million volunteers. There are more than 3,000 Extension offices throughout the Nation extending knowledge through programs which concentrate on farm and rural community needs.

The Extension Service's Agriculture and Natural Resources Staff (ES-ANR) is responsible for Extension programs in the area of red meat production at the national level. The efforts of this Staff are concentrated on the following high priority missions in support of ES and USDA missions:

1. To strengthen production and marketing capabilities of independent farmers which include: evaluation and application of science and technology in agriculture to increase efficient production; strengthening business management aspects in terms of acquisition and control of capital; proper combination of technology, enterprises, and effective marketing decisions; the strengthening and expansion of outlook programs on policy alternative facing farmers as they relate to farm income, structure of agriculture, agricultural markets, and related concerns.

2. To strengthen the ability of private institutions and organizations to serve commercial agriculture which includes: improved systems for marketing agricultural products and supplying inputs through work with farmers' cooperatives to strengthen management and operations; programs with national commodity organization; and work with other types of marketing and processing firms designed to improve the competitive structure and their management and technical capabilities to better serve commercial agriculture.

3. To help farmers adjust to Federal, State, and local regulations relating to environmental quality, farm and food safety, and plant and animal health which includes: programs to provide farmers and agriculturally-related business information about regulatory requirements affecting their operations from such agencies as APHIS-USDA, EPA, OSHA-Dol, and FDA-HEW; alternative approaches for meeting regulatory requirements with minimal adverse effects on farm productivity and income; and providing farmers and rural residents with a means of participating in the planning and reflecting on the consequences of, and needed adjustments in, regulatory programs.

4. Strengthening conservation and management of natural resources in rural America which includes: programs with producers and other rural residents to improve understanding and implementation of conservation, management, and multiple use of the Nation's natural resources, including soil, water, range, forests, wildlife, fisheries, and energy.

The ES-USDA meat animal program is incorporated in the above missions. In carrying out these missions, high priority is placed on business management, marketing, and environmental adjustments because business decisions are becoming increasingly important as the nation moves to a market-oriented agriculture with increased capital investment in farming and related businesses. Also, farmers are faced with increasingly stringent problems of changing environmental standards.

ES-USDA has a commodity program which strongly emphasizes involvement and cooperation with commodity organizations in the development of industry programs adopted to problems and needs of producers. ES-ANR and State Extension staffs, along with support from USDA research staff, are presently working with six commodity groups to jointly identify areas of educational need and develop additional programs and materials for State Extension Service and commodity leadership use with producers in agricultural technology, management, and marketing. The two major commodity groups (beef and sheep) which contribute to red meat production from range are included in industry development programs.

ANR works with State Extension Services to encourage further specialization of staff serving farmers and the application of multi-disciplinary approaches, particularly as it relates to implementing improved systems of production. Also, ANR plans a more intensive effort to speed up the application of new technology. Both of these areas include production of meat from range.

In carrying out the mission of ES-ANR, special emphasis is placed on rapid transfer of research results to agriculture producers. Cooperation across State and regional lines is encouraged in the conduct of programs and development of publications and teaching materials to complement and supplement those already in existence and reduce duplication of effort among the States. Combining appropriate disciplines to solve problems of clientele and multi-State programs are emphasized, particularly in industrywide and regional efforts in order to make more effective use of professional Extension State and Federal staff resources. Efficient and profitable production of meat from forages and range are included in these areas of emphasis.

FOREST SERVICE

The overall role of the Forest Service (FS) is to provide National leadership in Forestry (CFR, Title 7, Subtitle A, Part 2, Sec. 2.60). As used in the CFR and the Secretary's Delegation of Authority, "forestry" encompasses the tangible physical resources such as forests, forest-related rangeland, grassland, brushland, woodland, alpine areas, minerals, water areas, wildlife habitat, and less tangible forest-related values such as outdoor recreation, wilderness, scenery, air and water quality, economic strength, and social well-being.

A second role is to protect, manage, and administer the National Forest System. Administering programs of cooperation in the protection. planning, development, conservation, multiple-purpose management and utilization of forest and related resources is still another role for which the Forest Service has been delegated authority. In addition, the Forest Service conducts research programs to provide fundamental knowledge and technology for improved policy decisions and professional

management of forest and range ecosystems, increased efficiency in timber production; forest soils and watersheds; range, wildlife and fish habitat management; forest recreation, environmental forestry; and other resource areas.

To meet these responsibilities the Forest Service is organized into three program arms, each with distinct responsibilities as they relate to range:

- The National Forest System are (NFS) is responsible for the development, management and administration of grazing within the 187 million acres of Federally owned land in the National Forests, National Grasslands, and upon other lands administered by the FS.

- The State and Private Forestry arm (S&PF) has the responsibility to cooperate with counterpart Federal and State agencies to provide technical assistance on State and privately owned forest-range lands.

- The Research arm is responsible for providing fundamental knowledge and technology about forest-range ecosystems. (This report will not further discuss the range research role of FS.)

National Forest System

The Chief, Forest Service, is authorized to develop, administer and protect the range resources, and permit and regulate the grazing use of all kinds and classes of livestock in all National Forest System (NFS) lands and on other lands under Forest Service control (CFR 231.1). This authority extends to the National Forests, the National Grasslands, and to those other public and private lands for which the Forest Service has been given control of use through lease, agreement, waiver, or otherwise.

Under the basic authorization, the Forest Service makes certain of the National Forest System lands available for livestock use via a permit system. Objectives of the National Forest System range program include:

- Producing a fair share of the Nation's need for range forage by developing NFS ranges to their reasonably attainable potential.

- Improving and maintaining environmental quality of these ranges by managing the grazing in harmony with the needs of ohter resources and their uses and by exerting a favorable influence on associated private and other related lands.

- Contributing to the maintenance of viable rural economies by promoting stability of family ranches and farms of the areas in which the National Forests and National Grasslands are a part.

Under provisions of the Bankhead-Jones Farm Tenant Act and appropriate Secretary's Orders, three additional objectives relate to the administration of the National Grasslands:

- Promote the development of grassland agriculture in the areas of which the National Grasslands are a part.

- Secure sound conservation practices on associated private lands by coordinating the use of the Grasslands with the associated lands.

- Demonstrate multiple use management of the grassland ecosystems by coordinating livestock grazing with other resources and uses.

About 17,000 ranchers and farmers pay to graze 3.2 million cattle and sheep on 105 million acres of forest-range land on the National Forests and National Grasslands in the 48 conterminous States. An additional 3.0 million calves and lambs graze free of charge. These livestock graze on over 12,000 allotments, each with a management plan tailored for it. Each plan, based upon resource information specific to that allotment, specifies the number of livestock, season of grazing, fences and water developments needed, any needed seeding of depleted areas, and the grazing system to be used. Improved and intensive grazing systems have been implemented on over half of the allotments. These systems are specifically designed to provide for the maintenance and improvement of the basic soil and vegetative resources while at the same time producing the forage needed by livestock. In addition, the system provides for the other resources and uses of the forest-range such as wildlife and recreation.

More than 11 million animal unit months (AUM's) of forage are consumed annually by livestock grazing the NFS under paid permit. At the same time the range supplies forage and homes for hundreds of thousands of deer, elk, antelope and other big game and wildlife species.

Probably more important than just a source of forage is the complementary nature of the range. Grazing on National Forest System lands is mostly seasonal and provides the forage needed to make dependent livestock ranches and farms viable year-round operations, thus adding to the stability of the dependent rural communities. Without this complementary forage source, many operations would either have to buy or lease other range or reduce their operations, often ceasing to be an economic unit. In 1974 the grazing permittees will pay estimated $7.5 million dollars for the privilege of grazing on the National Forests and National Grasslands. Almost 850 professional man years are required annually to administer NFS range programs.

About 17 million acres of NFS range are in unsatisfactory condition and in need of improvement or rehabilitation. Most of these lands can be returned to satisfactory condition, using existing and available technology, providing adequate funding and manpower are available. Funds and manpower needs have been estimated that would enable National Forest System ranges to produce their fair share of the Nation's needs for forage while maintaining or improving the environment and without impairing other resources and their uses.

State and Private Forestry

The Forest Service, through its State and Private Forestry (S&PF) arm, formulates and conducts cooperative programs of forest-range management assistance to private and State landowners through State Forestry agencies or other designated agencies and through counterpart Federal agencies.

Assistance to other Federal agencies is carried out as stated in specific memoranda of understanding and agreements: Assistance is via cooperation with range management and related specialists from the other Federal and State agencies. Cooperation and coordination with the Soil Conservation Service, Extension Service, Agricultural Research Service, and other agencies having expertise is vital to the success of this assistance program.

Forest Service assistance programs in forest-range management are primarily concerned with (a) the reduction or elimination of improper livestock use in areas where such use is damaging basic soil and forest resources, and (b) the proper use and management of vegetation on those areas where livestock are being grazed or can be grazed without damaging soil and forest resources and still meet the objectives of the landowner.

The need is great, the job is big and the present program is far from adequate. About 85 million acres, or 1/5 of the 422 million acres of State and privately owned forest-range is believed to be grazed exploitatively, i.e., to the detriment of the forest resources. Because of the high potential of these ecosystems to produce forage, timber, and other forest resources, high priority should be given to assistance programs designed to correct this abuse.

To accomplish the assistance job additional funding and manpower will be needed. This will require increased appropriations for the Forest Service, additional incentive or cost sharing payments and additional inputs from the States.

Needs have been estimated for a Forest Service cooperative program in forest-range management. On a gradually accelerating basis, this program could eliminate exploitative grazing on private forest-range from 250,000 to 350,000 acres annually and secure proper grazing on 500,000 to 1,100,000 acres of forest-range annually within five years.

SOIL CONSERVATION SERVICE

The role of the Soil Conservation Service (SCS) is to provide national leadership in the conservation, development, and productive use of the Nation's soil, water, and related resources. Such leadership encompasses soil, water, plant, and wildlife conservation; small watershed protection and flood protection; and resource conservation and development. Integrated in these programs are erosion control, sediment reduction, pollution abatement, land use planning, multiple use, improvement of water quality, and several surveying and monitoring activities related to environmental quality. All are designed to assure: (1) quality in the natural resource base for sustained use; (2) quality in the environment to provide attractive, convenient, and satisfying places to live, work and play; and (3) quality in the standard of living based on community improvement and adequate income.

THE SCS ROLE IN RANGE

The SCS role in Range is carried out under two principal activities: direct assistance to livestock farmers and ranchers, and land inventory and monitoring.

Direct Assistance

Specifically, the conservation job of SCS on rangeland and related grazing land is to assist landowners and operators to:

1. Appraise the productive potential of their land and its suitability for forage, livestock, and related uses from the standpoint of climate, topography, soil, plants, and economic factors. Increases in rangeland production can be achieved through rangeland management systems that improve range condition and range plant vigor and provide for more efficient use of all forage.

2. Develop a sound and economic conservation plan for their operating units based on a scientific inventory of soil, water and total forage resources. SCS has the technical knowledge and experience, a method of operations, and the nucleus of trained, experienced personnel needed to bring this about on non-Federal grazing lands. Accelerating rangeland efficiency can be accomplished by accelerating the assistance job. This will require additional funding and personnel. New production specialists trained in grazing land management can be the major force in this acceleration. These specialists would be field based and would furnish direct assistance to field offices in providing one-to-one assistance to livestock farmers and ranchers to plan and install a whole farm or ranch conservation program. Such programs, as they do now, would provide for protection of the grazing land resources while producing more usable forage.

3. Reduce soil and water losses and aid in restoring and improving forage resources by applying sound conservation measures. SCS experience indicates that carefully developed grazing systems applied along with needed supplementary practices such as brush management, fencing, and livestock water development can bring about significant increases in rangeland production. (Reports of 25 to 30 percent increases have been noted in some instances.) Significant increases in meat production are reported, too, from balancing year-round forage supplies with livestock needs on native grazing lands, pasturelands, and cropland, a need common to many livestock farms and ranches.

4. Enhance and maintain a permanent, stable, and productive livestock industry with as complete utilization of the forage crop as is consistent with protection of the soil resource and permanence of forage production. Recent studies in some states by SCS and cooperating land grant universities have shown that improving private grazing lands one condition class--from good to excellent--or fair to good--would result in increased livestock production of 2-4 million animal unit months. When translated into dollars, this would bring about an increased net return to operators of from $4,000,000 to $8,000,000.

5. Consider multiple use alternatives which are compatible with grazing use and have potential for bolstering income.

Land Inventory and Monitoring

SCS has nationwide responsibility for certain land inventory and monitoring activities of the U. S. Department of Agriculture. This includes the National Cooperative Soil Survey. Ranges are covered under this survey and the resultant soil surveys, when combined with necessary interpretative data, are very helpful in developing alternative grazing land management systems. USDA leadership for the Conservation Needs Inventory is a second SCS responsibility. This Inventory determines, and periodically updates, conservation needso of the nation's soil, water, and related resources in non-Federal ownership. It is used by soil and water conservation districts in developing their long-range programs and is used by the U. S. Department of Agriculture to develop programs of assistance to farmers and ranchers.

WORKING ARRANGEMENTS

SCS works through soil and water conservation districts (SWCD's) to provide direct assistance in resource conservation planning and application to landowners and grazing land operators. SWCD's are legal entities of State governments responsible for natural resource conservation programs in their districts. Direct one-to-one assistance to help the rancher and livestock farmer plan and apply a complete range conservation program on his land is a key element of the SCS program.

Special working arrangements have been developed with the U.S. Department of the Interior, Bureau of Land Management, to improve service to cooperators using intermingled public and private lands. A working agreement is in effect between the SCS and the Farmers Home Administration to provide for coordinating technical assistance from SCS to FmHA-financed grazing associations. SCS also cooperates with the Bureau of Sport Fisheries and Wildlife and the National Park Service of the U. S. Department of the Interior in providing technical assistance on wildlife refuges and big game ranges.

Working arrangements with the Agricultural Research Service include an agreement on a study of hydrologic characteristics on native grazing lands for which SCS will provide descriptions of vegetation and soils where sampling will take place.

SCS works closely with many State agencies in providing technical expertise in resource conservation and development and in direct assistance in grazing land management on State-owned lands. It works closely with State land grant universities in developing technical materials for joint use in developing range science curricula.

METHOD OF OPERATION

SCS carries on an action program of direct assistance on the land to the rancher and livestock farmer. Through local field offices in nearly every county in the United States, SCS district conservationists and their staffs work directly with the landowner or operator on many phases of his farm program. This includes: inventory of soil, plant, and animal resources; present alternative combinations of conservation practices and management (resource management systems); helping reach decisions on accomplishing conservation objectives; and, providing assistance in installing his conservation programs.

Because most livestock operations depend on several kinds of land (such as rangeland, pastureland, hayland, cropland, grazeable woodland, and native pasture) for their total forage resources, the district conservationist must be knowledgeable in several fields.

Aiding him both for training and direct assistance are field specialists in range, forestry, agronomy, wildlife biology, soils, and engineering. Among these field specialists are some 200 field specialists actually classified as range conservationists. Other range trained men fill about 300 additional positions in SCS, including key administrative positions.

PROGRAM INFORMATION

SOIL CONSERVATION SERVICE

The U. S. Department of Agriculture Conservation Needs Inventory (1967) records 694.9 million acres of privately controlled grazing land in the United States (the 48 contiguous States) as follows:

Category	Acres (million)
Rangeland	379.9
Woodland grazed	136.3
Pastureland	101.1
Hayland	27.2
Cropland grazed (in cropping system)	50.4
Total	694.9

Grazing land conservation and improvement practices planned and applied on the land are shown below:

Practice	Millions of Units	Applied During FY '73	On the Land to Date
Proper Grazing Use	Ac.	53.8	257.4
Planned Grazing Systems	Ac.	6.4	36.7
Pasture & Hayland Mgmt.	Ac.	11.4	66.0
Pasture Seeding	Ac.	3.2	70.5
Range Seeding	Ac.	.4	15.9
Brush Management	Ac.	4.1	50.6
Stock Water Development			
Wells	No.	---	.6
Troughs and Tanks	No.	---	.5
Ponds	No.	---	1.9
Fencing	Mi.	---	.5

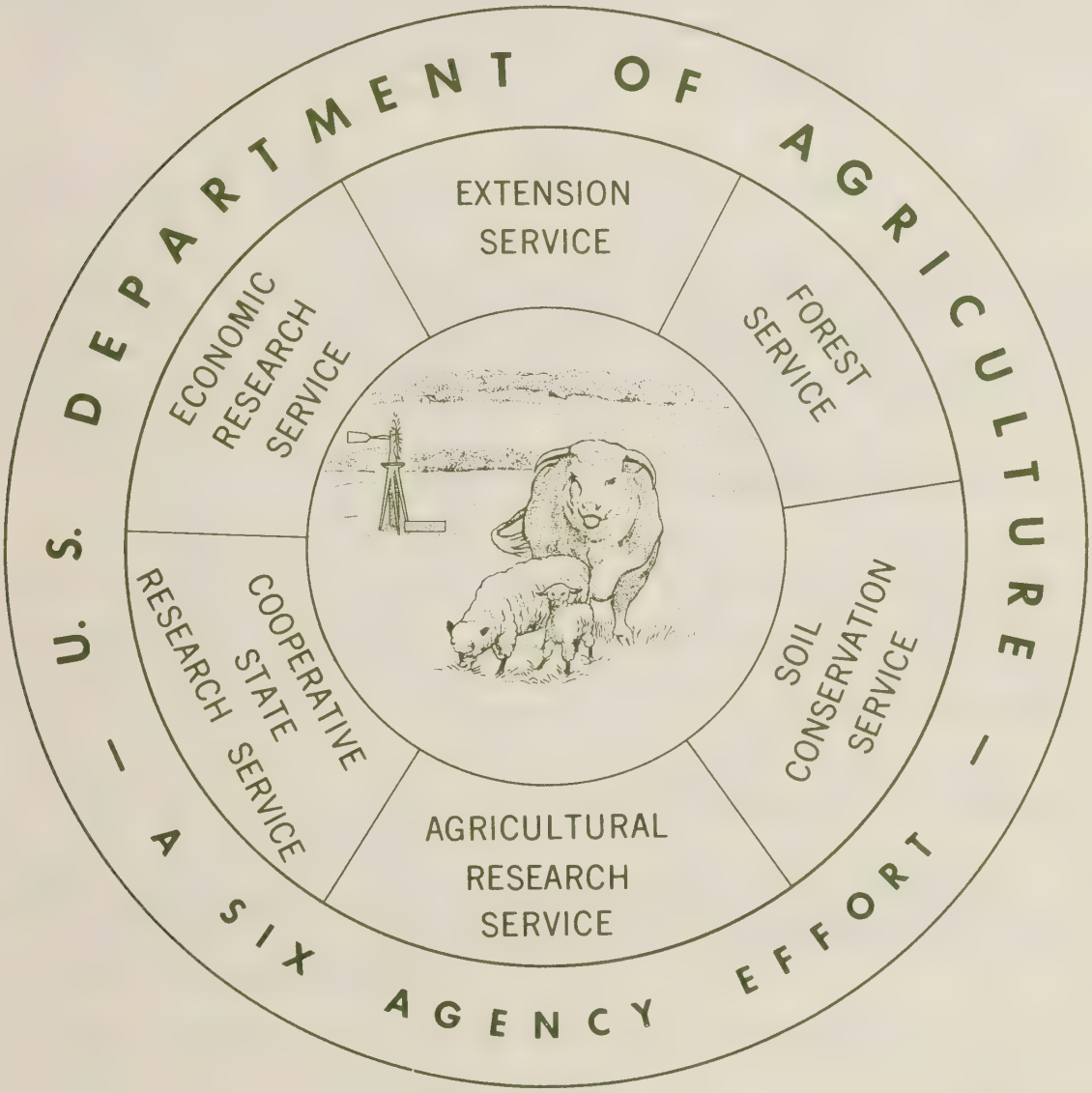
AGRICULTURAL RESEARCH SERVICE

The Agricultural Research Service conducts basic and applied research in the fields of livestock, plant sciences, plant and animal protection, soil, water conservation, agricultural engineering, and several others. Its research on rangelands is conducted at 27 locations in the 17 Western States. The principal objectives of the ARS range research include the development of more efficient production of forages and livestock, conservation of soil and water, development of watersheds, and improvement in range management systems which have multiple-use capabilities for livestock, water, wildlife, recreation, and aesthetic values.

In fulfilling these research objectives, ARS also has nonresearch functions within its mission to provide essential transfer of new information through the medium of workshops, training courses, field days, and releases of information through the mass media. For example, workshops are held to inform such public and private agencies as the Soil Conservation Service, Bureau of Land Management, and the National Association of Conservation Districts to hasten the transfer of new research information to nonresearch agencies, ranchers, and industry-related groups. ARS compiles data from hydrologic research on rangeland watersheds for use in developing stocking guides. Agency scientists are frequently called upon to contribute to workshops, training courses, and other activities as part of cooperative relationships between ARS and State Agricultural Experiment Stations, Extension Service, other Federal action agencies, and local governments.

GPO 882-031

Opportunities to Increase Red Meat Production From Ranges of the United States



EXECUTIVE SUMMARY

Phase I -- Non-Research

JUNE 1974

ABSTRACT

The range in the United States and its uses and current technology are described and its interrelations with other forage and feed sources shown. Issues affecting current and prospective demands for range are discussed and two demand levels are presented. Capability of the range to achieve the projected demands for livestock grazing is explored and non-research opportunities are presented for increasing range forage supply. A partial assessment of benefits and costs from range programs is included.

PREFACE

Mid-1974 presents a surplus of meat in the U. S. and in world markets. This situation is closely associated with the economic and political issues discussed in this report. The writers believe the evidence strongly suggests this over-supply situation is temporary and that demand for meat will shortly continue its upward trends, supporting the case for more range forage. The need remains high for planning now for more effective use of range to meet expected long-term higher demands in the year 2000.

The report was conceptualized by the USDA Work Group on Range Production and written by C. H. Hanson (ARS), Harlow J. Hodgson and C. Wayne Cook (CSRS), Calvin Boykin (ERS), Dixon Hubbard (ES), Jack E. Schmautz and Melvin D. Bellinger (FS), Donald R. Robertson (SCS), and Robert S. Rummell (FS), Coordinator, USDA Work Group on Range Production.

This Executive Summary was prepared from a full report which is available as a separate document.

Details of range demand, productivity, relevant issues, range base and its uses, the USDA role and opportunities and support information are found in the main Phase I report.

HIGHLIGHTS

Rangeland, the largest single category of land in the United States, has no alternative for contributing to food for man other than by way of grazing animals. When efficiently developed and managed, ranges (grasslands and shrublands and forest areas that produce forage) are competitive with other forage sources and they can be grazed under systems that enhance the environment. Other benefits from proper consideration of ranges include conservation of fossil fuel, and assistance with balance of payments deficits.

Ranges of the United States have potential to produce livestock grazing at higher levels with efficiency to help meet the Nation's need for red meat in the years 1985 to year 2000.

The U. S. Department of Agriculture should fully exercise its broad authorities and responsibilities in assuring that the capabilities of all ranges are used more effectively toward meeting national economic social and environmental goals. Needs and opportunities for accomplishing this objective include:

--eliminating the disparity in USDA policy emphasis between range and crop production

--more fully utilizing the Department's educational resources

--accelerating technical assistance to all range operators

--demonstrating optimum range management systems on the National Forest System and associated private lands

--developing and managing the National Forest System to its full economic potential, and

--changing the USDA meat quality grades to reflect consumer preference and recognize the nutritional value of forage-fed and range-fed beef

These needs and opportunities and others are discussed in the full report.

CONTENTS

OPPORTUNITIES TO INCREASE RED MEAT PRODUCTION FROM RANGES OF THE USA (NON-RESEARCH)

U. S. DEPARTMENT OF AGRICULTURE

THE ASSIGNMENT

The report upon which this Executive Summary is based was commissioned in December 1973 by Robert W. Long, Assistant Secretary of Agriculture for Conservation, Research and Education.

A Work Group representing the five USDA Agencies in Conservation, Research and Education was assigned to "prepare a USDA viewpoint on accelerated meat production from rangelands." The Group was expanded to include Economic Research Service.

Objectives of the study as defined by the Work Group was:

> *"To present for consideration of the Secretary a report on cost-effective opportunities to increase red meat production from America's ranges by a program of research, education, extension cooperation and action, giving consideration for environmental values and contributing to rural development."*

Scope of the assignment was modified by the Assistant Secretary and his Agency Heads to a two-phase effort.

--Phase I--Opportunities excluding Research

Preparation of recommended programs and necessary financial plans for achieving the opportunities was not to be part of the Phase I effort.

--Phase II--Research Opportunities

Phase II is to be developed over the next six months.

RANGE AND DEMAND FOR ITS USE

Range is all land producing native forage for animal consumption and land that is revegetated naturally or artificially that is managed like native vegetation. Range embraces forest lands that support an understory or periodic cover of herbaceous or shrubby vegetation available for large herbivores.

Rangeland has been defined as "land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs or shrubs suitable for grazing or browsing use. Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes and wet meadows."

Range, consisting of grasslands, shrublands and open forests, covers more than one billion acres--54 percent of the land area of the 48 States. Included in these definitions are sizeable areas in the humid portions of the nation that many would term pastures and forage-producing lands. Because of climate and soil, rangelands (grasslands and shrublands) cannot grow cultivated crops consistently year after year. For the most part, these lands have no alternative for contributing to food production for man other than by way of the grazing animal. Yet they have many other values and uses including watershed, wildlife habitat, and recreation.

DEMAND

Increased long-range demands are expected for range forage as a direct response to need for a sustained increased supply of red meat at acceptable prices to consumers and reasonable profits to producers. Supporting this conclusion are recent complex interactions of economic, political, and social factors including:

--world markets for grain, vegetable protein and meat

--balance of payments deficit

--changing price relationships

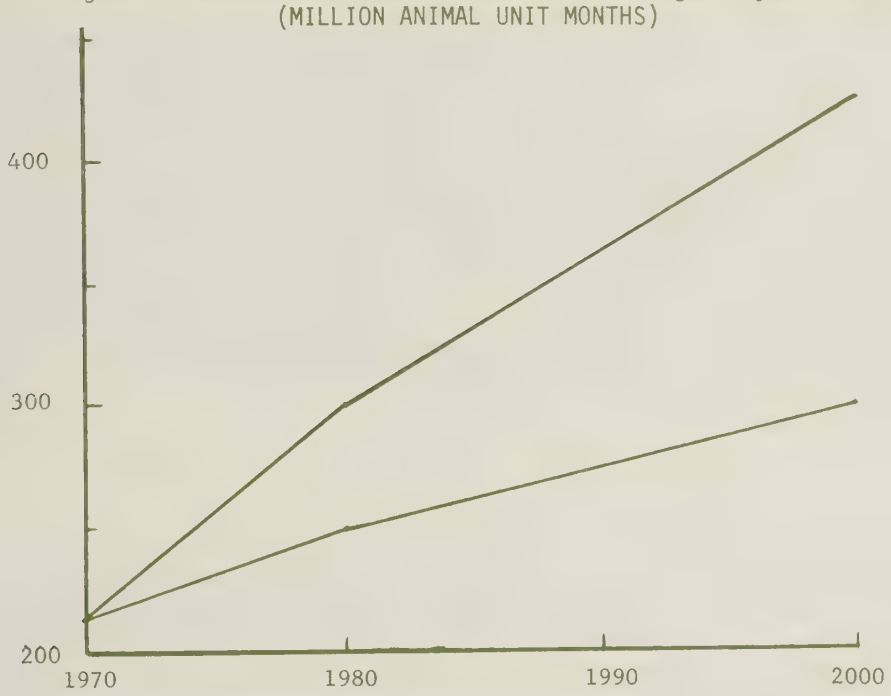
--energy problems and fossil fuel shortages

--use of agricultural lands for other purposes, and

--associated factors

Given the changing nature of the many interrelated factors and resultant expected increases in demand for range, two demand estimates for range have been developed (Figure 1).

Figure 1.--Estimated limits of demand for range to year 2000
(MILLION ANIMAL UNIT MONTHS)



The demand estimates for range are aimed at year 1985 primarily but are extended to year 2000 because of long-range planning needs and the often lengthy response time of range improvements and management systems. Projections of population, gross national product (GNP), disposable income, etc., are the same in both demand levels. Also common to both demand levels are such range-related factors as amount of land available for range and/or other uses.

The low demand estimate results in an anticipated increase in range grazing requirements of 18 percent by 1980 and of 24 percent by year 1985. For this estimate to be valid, many of the economic, technological and attitudinal events of the last three years must be considered as temporary.

The high demand estimate assumes a continuing and increasing preference for beef. Thus, the per capita consumption of beef continues to increase in spite of increases in beef price levels relative to other foods, and increases in general food price levels relative to the 1950-1970 period. However, large available supplies of plant protein could replace part of the demand. The increased consumption of beef in a higher price situation is possible since the projection of increased personal income permits a higher absolute quantity of dollars flowing to food items.

The accumulative effect of assumed higher relative prices of livestock feeds, increased exports of agricultural products (grains and soybeans) and increased production costs for grains resulting from higher prices for energy, reduces the quantity of non-grazed feeds available for livestock and increases their price. (An effect of high grain prices on beef feeding is indicated by a 40 percent drop in number of cattle entering feedlots in May 1974 compared to May 1973, in spite of increased cow numbers in 1973.) The relative value of grazing increases in response to the overall demand for livestock products and the proportion of beef produced in feedlots remains at 1960-70 levels. Range demand increases 40 percent by 1980 and by 55 percent by 1985 at the high level.

RELATED ISSUES

The economy has been expanding faster than its natural resources would permit. This has shown up in either sharply rising prices or absolute shortages of products derived directly from forestry, agriculture, minerals and metals, and especially from energy. Such scarcities, particularly in fossil fuel, come at a time when agriculture and other raw material segments of the economy are being used in world trade to ease the balance of payments deficit.

Prospects are that increased U. S. exports of grain and vegetable proteins will continue. These higher export levels, while helping overcome the dollar deficit, will result in lower domestic supply, increased domestic prices for these products, and create a need to alter existing systems of meat production, including range use.

Several adjustments may occur as a result of the expected continuance of higher feed grain prices. First, cattle feeders may include more forage in their rations, particularly if cattle continue coming into the feedlot at lighter weights. This would place a higher demand on forages. Second, cattle could be placed on feed at heavier weights, with the result that increased forage demands would be placed on both range and cropland forages. Thirdly, a movement toward grass-fat cattle as a system may become a reality if the prices of feed grains remain exceptionally high and if consumer acceptance of grass-fat beef can be achieved and if changes of meat grades could be made.

Feed grains now constitute the highest proportion of total livestock feed requirements in history and more cattle than ever are being fed. This increased feeding of grain has resulted in the highest inputs ever in fossil fuel energy applied to cattle through feed grains. Increased development and utilization of range for livestock production can reduce the drain on future national energy requirements for meat animal production. Production of livestock on a range basis requires lower energy input from fossil fuel sources than do production systems heavily dependent upon feed grains.

POTENTIAL OF RANGE TO MEET PROJECTED DEMAND

Given a normal climate, capital to invest in available improved range technology, recognition that grazing is compatible with other range uses, and means for overcoming inertia, ranges of the U. S. can produce more forage. These lands, including eastern range areas, have potential that is not being used at today's demand. They have potential that can help meet tomorrow's expected higher demands.

THE RANGE BASE

Of the 1.2 billion acres of forest and rangeland, 69 percent is non-Federally owned and 835 million acres were grazed in 1970. Thirty percent of this grazed area was forest.

Production of grazing from ranges approximated 213 million animal unit months in 1970. This is the equivalent of supplying the year-long forage requirements for about 17 million cows, which is about 40 percent of the beef cow population for that year. Of the 213 million AUM's, only 14 percent came from the Federal lands, with 86 percent from the non-Federal sector.

Many ranges are used as integral parts of a forage-feed system that includes cropland forages, improved pastures, hay, silage, or other sources of livestock feed energy. Most Federal grazing lands compose part or all of a seasonal supply of forage for stabilizing ranching operations and rural agricultural communities.

RANGE POTENTIAL

The range has a potential that can be developed to meet the highest predicted demand for grazing (426 million AUM's per year). This means investments in improvements and management. Range, as a source of livestock feeds, remains competitive at the

high demand levels in the face of increasing cost for range facilities because the implications of recent events cause marked increases in costs of alternative feed sources. If the per capita consumption of beef, the export of feed grains, and the increased price and shortage of fuels continue on the trends of the last 3 years, the competitive cost position of range may even improve at the higher demand levels.

Intensive management of all of the available range area would result in production of 566 million AUM's and this production could be achieved within the multiple use context. However, this supply level exceeds estimated demands. In addition, application of intensive management to all lands denies the existence of differences in the relative capability of the many range ecosystems, as well as the differences in productivity from site to site within an ecosystem.

The ultimate production capacity of the range of 1,700 million AUM's is over 8 times current production (an estimated 213 million AUM's) and 4 to 5 times the probable quantity demanded. The extreme high represented by this estimate is not an acceptable measure of real capacity. Achievement of that ultimate level of output would be very expensive in terms of environmental impact and in the reduction of other outputs now produced by the same land. It would result only from maximizing livestock output upon a large portion of forest areas as well as rangelands, and this is unacceptable.

Properly managed, most range ecosystems can be grazed without undue stress on alternative uses such as watershed protection, wildlife habitat, timber production and recreation. In the range of competitive relationships between or among these uses, product prices and rates of substitution would allocate the uses of ranges to the most profitable arrangement. To a large degree these uses may be complementary or supplementary, resulting in situations where multiple uses have a place, with no one specific use detracting economically from returns from the other use or uses. However, some ranges have been allocated to non-range uses, thus placing more pressure upon a smaller production base.

BENEFITS AND COSTS

A detailed and quantitative evaluation of a USDA range program needed to achieve an efficient increase in red meat production through the proper utilization of range requires assessment of all beneficial effects (benefits) and all adverse effects (costs). Many data elements of such information are not now available. Listed herewith are "benefits" and "costs" that should be considered:

SELECTED RANGE BENEFITS AND COSTS

BENEFITS

Commodity & World Trade	Rural Development	Environmental
More beef and lamb	*Increased rural income*	*Quality of water maintained*
More wool and mohair	*Increased rural economic activity and development*	*Stream sediment loads not increased*
Increased agricultural exports		*Wildlife and natural beauty not impaired*
Improved balance of trade		*Improved condition of NFS ranges*
Lower relative use of fossil fuels and fertilizer		
Wood growth and water yield maintained		
Lower total cost for a given level of agricultural production		
Lower relative food costs .		

COSTS

Investments	Expenditures
USDA	
--NFS range (direct land improvements)	*--technical assistance*
--education	*--incentive payments*
--demonstration	*--cost sharing*
State Agencies	
	--technical assistance
Private	
--land (land improvements)	*--operating costs, interest*
--livestock	*--risk*
--other livestock operation facilities	

RECOMMENDATIONS

With its broad agricultural responsibilities, encompassing both direct relationships with the agricultural production community, as well as its public land administration responsibilities, the United States Department of Agriculture has a key role in the degree to which range can contribute to the economic, environmental and social well-being of the Nation.

Current world events, including higher long-term demand for red meat and the high input of fossil fuel for cereal crops, strongly suggest this is a time of great opportunity for USDA to plan effectively for exerting its responsibilities in range. Long-term economic, social, and environmental benefits will result.

The USDA Work Group on Range Production recommends that full (USDA) inter-agency staff consideration be given to the following in developing long-range programs that involve range as herein defined. We further recommend that USDA agencies outside the area of authority of the Assistant Secretary for Conservation, Research and Education be consulted as their interests are involved and that the effort be expanded to other departments of Federal and State government as opportunities are recognized. The Work Group urges that full consideration be given to the need for sustained long-term commitments of personnel, facilities and financing because of the lengthy response time of range development and management systems.

PRIORITY FOR RANGE

Eliminate the disparity in USDA policy emphasis between range production and crop production and give range a higher level of priority and emphasis.

Although range has contributed greatly in meeting this Nation's needs for food and fiber, emphasis over the past 40 years has been on crop production, confinement feeding of livestock, and intensive high yield per acre. This report indicates the real opportunity values of range to livestock production. However, there needs to be a shift of emphasis, of priorities, if the productive opportunity of range is to be realized. This review suggests strongly the need to exercise a higher degree of concern for Range. The complementarity of range with other sources of livestock feed energy, not range as a supplement to them, needs stressing.

EDUCATION

More fully utilize the Department's educational resources in communicating the opportunities, technologies and values of range to producers.

Known range technology is not being applied to the extent possible. Agencies of the USDA should pool their resources and join with appropriate State and other agencies, universities and professional groups, such as the Society for Range Management, in surfacing, sampling, selecting, and selling existing range technology. The objective should be to get range technology fully and expeditiously into use.

TECHNICAL ASSISTANCE

Accelerate technical assistance to all U. S. range operators.

Effective use of existing range technology needs to be extended both through education and direct assistance. Significant progress toward better use of ranges has resulted from assistance to private landowners. Special emphasis on assistance is needed in the South and Southeast where range production potentials are high. Little assistance has been provided small forest landowners in proper grazing of livestock on their forest areas toward the goal of higher annual cash incomes and higher timber growth.

DEMONSTRATIONS

Establish a demonstration program on public lands administered by the Department and on associated non-Federal lands which incorporates the total knowledge base of USDA agencies and land grant universities into an optimum range management program.

In the National Forest System, the United States Department of Agriculture has a land base upon which it can demonstrate the best there is in range management. These lands extend through 44 States, include most of the many different range ecosystems and contain grazed area in 36 States. USDA agencies together with State representation and private cooperators should pool their knowledge and their resources and apply them effectively on these lands.

Conceivably, such demonstrations could serve as testing grounds for new research that has reached pilot-scale testing level. They could also provide feedback to test the validity of generally accepted practices. They should be tied to strong education and technical assistance programs. Successful demonstrations of sound range management systems on non-Federal lands should be fully utilized toward accelerating acceptance and installation of proven range management systems.

PUBLIC LAND MANAGEMENT

Establish range programs that will enable the National Forests and National Grasslands to fulfill their role in meeting National needs.

The National Forests and National Grasslands, about 1/8 of the range land area base, are a fundamental USDA tool for development of low-cost range forages. National Forest System ranges are the most direct tool for investment in range available to the USDA.

The range resources of the National Forests and National Grasslands should be developed and managed at levels at which they are economically and environmentally competitive with other Federal and non-Federal ranges.

RURAL COMMUNITY DEVELOPMENT

Foster rural community development through improving range management.

Hundreds of Western and Southern rural communities depend heavily upon cash flows generated from livestock raising on a range basis. An accelerated USDA range effort resulting in better range management, effectively applied, would mean more income and more stability to these communities. In addition, increased range production could have the desirable effect of slowing migration of younger people from these range-oriented areas. A set of management systems based on business management specifically developed for these purposes and tied to strong educational, technical assistance, demonstration, and incentives, would be very effective.

USDA MEAT QUALITY GRADING

Change the USDA meat quality grades so that they are not discriminatory and better reflect consumer preference.

Current quality grades favor grain-fed beef animals and make it uneconomical to market grass-fed beef.

If the fossil-fuel energy efficiencies of range beef production are to be fully realized, the meat grading system needs to be adjusted. The nutritional equality and health-advantages of forage-produced beef with grain-fed beef need to be revealed.

FINANCING AND INCENTIVES

Develop improved financing and incentive programs for range operators.

In the main, investment capital for range improvement is quite scarce and is limited to the larger operators with considerable equity. Application of range improvements on the scale necessary for meeting increasing demands for ranges to produce meat will require government participation through offering guarantees and appropriate interest rates on loans of a longer-term nature with built-in flexible repayment schedules.

Improved incentives or cost-share programs will be an important aid in assuring installation of range management systems planned by the land user with technical assistance from USDA agencies. Long-term agreements should be favored over short-term agreements. In addition, there is a need to establish the cost-sharing or incentive aspects of improved grazing programs on forest lands.

RANGE INFORMATION SYSTEM

Develop and maintain a dynamic resources and economic information base and monitoring system.

Better information is needed about the Nation's range resources, their use, and contributions to the total economy. The current related resource base and other statistical and economic intelligence is not aggregated into an efficient system reliable for, and usable for long range planning. For example, there is no national recurring inventory or survey of range resources such as is available for forest resources. Nor is there a planning system that associates range with other livestock production opportunities from which alternatives could be derived for setting national policy.

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